FLIGHT

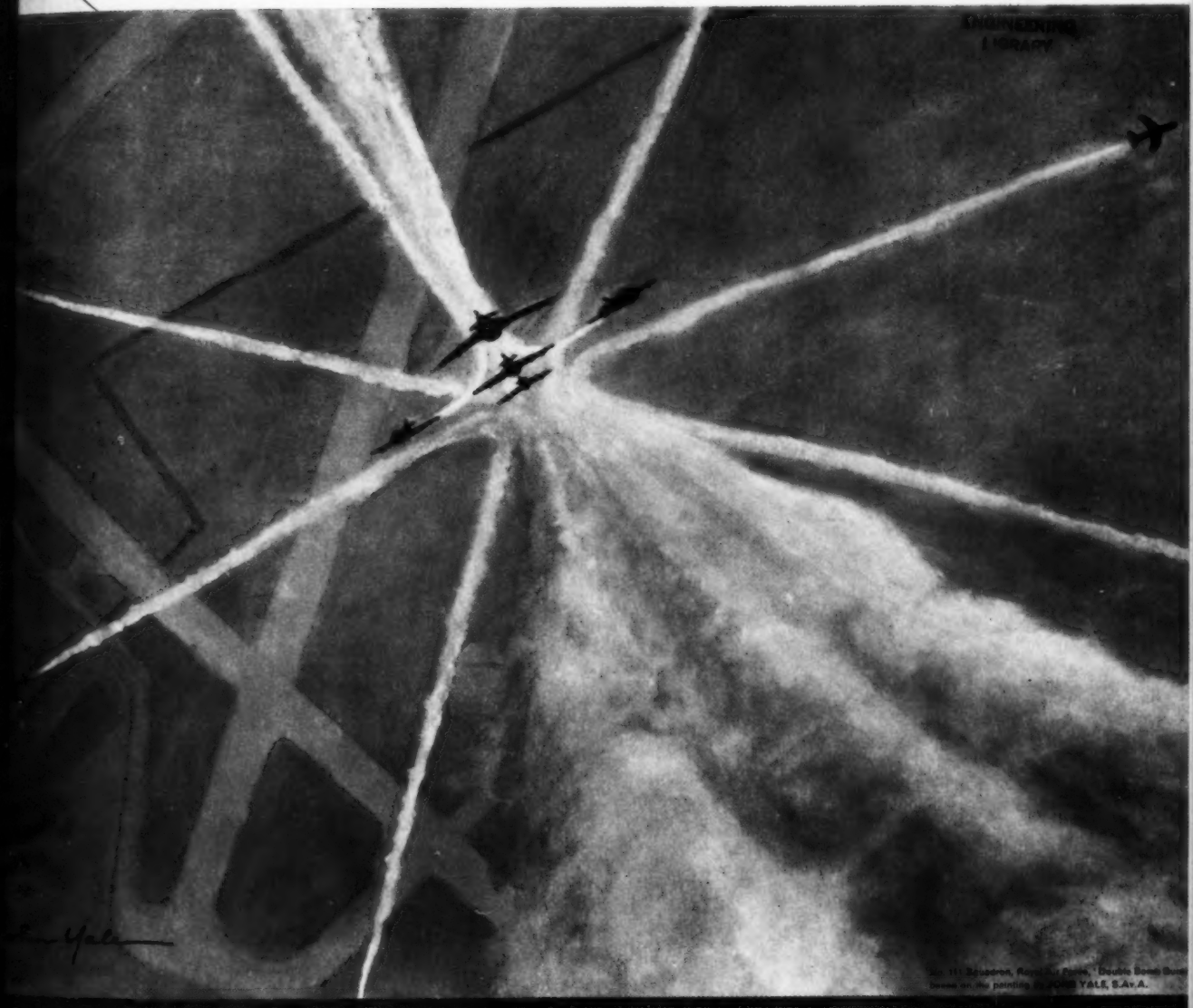
Aircraft, Spacecraft, Missiles

Farnborough Report

SPECIAL NUMBER

7 September 1961
One shilling & sixpence

THE UNIVERSITY
OF MICHIGAN
SEP 29 1961
ENGINEERING
LIBRARY



THE RAF BENEVOLENT FUND
NEEDS £500,000 A YEAR
GIVE GENEROUSLY BATTLE OF BRITAIN WEEK SEPT. 11-17TH

New Boeing 727 jetliner to be powered by 3 Pratt & Whitney Aircraft turbofan engines

The engine is the JT8D Designed and manufactured by Pratt & Whitney Aircraft, it uses two features from their proven family of engines. The JT8D inherits the basic technology of the JT3 and JT4 turbojets with more than 15 million hours of reliability. And from the turbofan engines powering the long-range Boeing and Douglas jetliners, the JT8D inherits the design for its forward fan. The JT8D will power the new 727 fleets ordered by Lufthansa, American Airlines, Eastern Air Lines and United Air Lines. Turning out 14,000 pounds of take-off thrust, with exceptionally low fuel consumption, the JT8D will help make it possible to operate from runways that used to be too short for modern jet travel.

United Aircraft International

East Hartford 8, Connecticut, U.S.A.

HAMILTON STANDARD · SIKORSKY · NORDEN

European Headquarters: 3/5 Warwick House Street, London S.W. 1, England

Second Class Postage Paid at New York, N.Y.

VICKERS V.C.10
Incorporating
Boulton Paul Power Controls

PUTTING US IN THE PICTURE

Optimum performance of the spoilers of the V.C.10 aircraft in their dual role of airbrakes and augmentation of aileron power, is assured by the use of Boulton Paul Spoiler Jacks incorporating rotary control valves. Precision positioning and high system rigidity are hallmarks of this design.

Past performance is a guarantee of future reliability.

LOOK TO B.P.A.

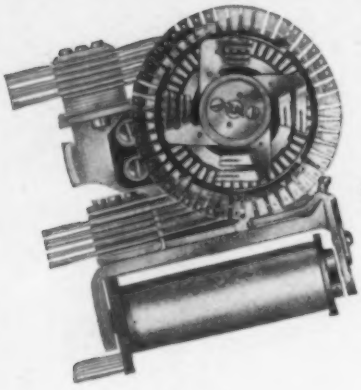
for power control systems to meet new requirements.

BOULTON PAUL AIRCRAFT LTD

A MEMBER OF THE DOWTY GROUP

WOLVERHAMPTON · ENGLAND

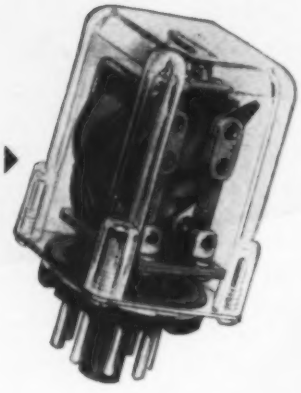
THORN RELAYS



◀ 3 IN 1 RELAY

◀ SENSITIVE D.C. RELAY

PYGMY POWER RELAY ▶



THERMAL TIME DELAY RELAY ▶

THREE-IN-ONE. Stepping Relay. . . Rotary Switch . . . Relay . . . all in one, yet only slightly larger than a conventional relay!

1. STEPPING RELAY Ratchet driven with two cams which operate 2 c/o contacts on the 6th position of each switch quadrant, returning to normal on the 7th position.
2. ROTARY SWITCH Ratchet driven with four banks of twelve points each with bifurcated spring wipers. Transparent dust-cap fitted as standard.
3. STANDARD RELAY Knife-edge armature pivot operating 2 c/o and 1 n/o contacts.

This unit has wide application in automation, counting and tallying operations, automatic test equipment sequencing on memory storage, remote control and telemetering.

PYGMY POWER RELAY. Interchangeable relay for use in remotely controlled automation units. 2 pole and 3 pole changeover contacts. Dust proof-transparent polystyrene cover. Plugs into standard I.O. and B.11A bases respectively Only 4½ ozs. . . . projection only 2" above base. Mechanical life over 10,000,000 operations.

THERMAL TIME DELAY RELAY. Convenient for control purposes in communication, computors and automation. The relay may be heated with direct or alternating current, the heater resistance is rated for an output of 3-6 watts. With relays having a reduced pick-up time (3-12 secs) the heater output may amount to 9 watts at maximum. Though hermetically sealed the relays are adjustable within the following ranges 3-12 secs, 10-30 secs, 25-60 secs, 50-110 secs, 100-200 secs. Maximum heater voltage 115V AC or DC.

SENSITIVE D.C. RELAY. This small and highly versatile relay is available with contact arrangements from 1 pole normally open up to 8 pole changeovers.

Typical Contact Ratings—2 pole c/o 220V-30W or 300 VA. 8 pole c/o 120V-30W or 120VA.

Operate Power. From 15mW (min) to 1·0 Watts, depending on contact arrangements.

They can be supplied with a dust proof case, or be hermetically sealed, and with plug-in or solder tags, including printed circuit terminations.

For further information, please write to:

THORN ELECTRICAL INDUSTRIES LIMITED

Special Products Division, Great Cambridge Rd. Enfield, Middlesex. Enfield 5353

DTV/M

developments in flight equipment...

HIGH PRESSURE REDUCING VALVES

Even when the pressure ratio is high, Hymatic reducing valves still maintain a close pressure control over a wide range of flows. This makes possible the use of high storage pressures giving a saving of space and weight. Applications are pressurisation and purging of fuel systems, cooling air supply to, and pressurising of, electronic equipment. The Hymatic valve PS.64 is an example. It reduces inlet pressures between 150 and 4500 p.s.i. to 0·5 p.s.i. and precisely controls the outlet to within ± 0·1 p.s.i. with varying flows upwards of 90 c.f.m.

Hymatic, as leading engineers in the Aircraft equipment field, have been responsible for the design and precision manufacturing of many products, including:

Non-return valves
Pressure maintaining valves
Stop valves
Ventilated suit system equipment
Sequence valves
Hot air reducing valves
Test rigs
High flow reducing valves

...by **Hymatic**

THE HYMATIC ENGINEERING COMPANY LIMITED
REDDITCH · WORCESTERSHIRE

193

Royal Air Force photograph — Crown copyright reserved

R.A.F. Coastal Command

make full use of the WILLIAMSON F117 AIR CAMERA as a general service instrument for medium and lower level spotting, maritime reconnaissance and all aspects of aerial photography. Automatic re-wind maintains continuous focussing on target and takes up to two exposures per second.

There are four versions — manually operated, electrically-operated hand-held, fixed mounting, and handheld electrically operated with internal power supply (F117E as illustrated)

Brief specification:
Exposures: 110.
Shutter speeds 1/400, 1/250, 1/125, and 1/60.
Format 4½ x 4½ in.

Prices and delivery times will be given on request to:

WILLIAMSON
Manufacturing Company Limited

Photographic Engineers, Willesden Green, London, N.W.10 Tel : WILlesden 0073 'Grams : Kinetogram, London

FERRANTI

ELECTRONIC & GYROSCOPIC EQUIPMENTS

Ferranti are able to offer a wide range of Gyroscopic and Transistorised equipments for all types of aircraft. The main features of these equipments are their high reliability and efficiency, coupled with light-weight and small space demands. Many units are hermetically sealed.

All Ferranti equipments are fully supported by a world-wide technical service organisation and conform to British Civil Air Requirements (B.C.A.R.).

★ Artificial Horizons in 4½" and 3¼" cases.
★ Horizon Gyros.
★ Vertical Signalling Gyros.
★ Helicopter Flight Instrument Systems.
★ Inertial Navigation Systems.
★ Transformer Rectifier Units.
★ Transistorised Static Inverters, Converters and Voltage Regulators.
★ Vocal Audio Warning System.

FERRANTI

First into the Future

Enquiries to :- **FERRANTI LTD.**
AIRCRAFT EQUIPMENT DEPT. MOSTON, MANCHESTER 10
Telephone : FAllsworth 2071
or WESTWICK, BRACKNELL, BERKSHIRE
Telephone : Bracknell 1211

FAE 7

If you want to know anything about current developments in the fields of thermal and acoustic insulation or glass reinforced plastics.....

Call on

FIBREGLASS
TRADE MARK

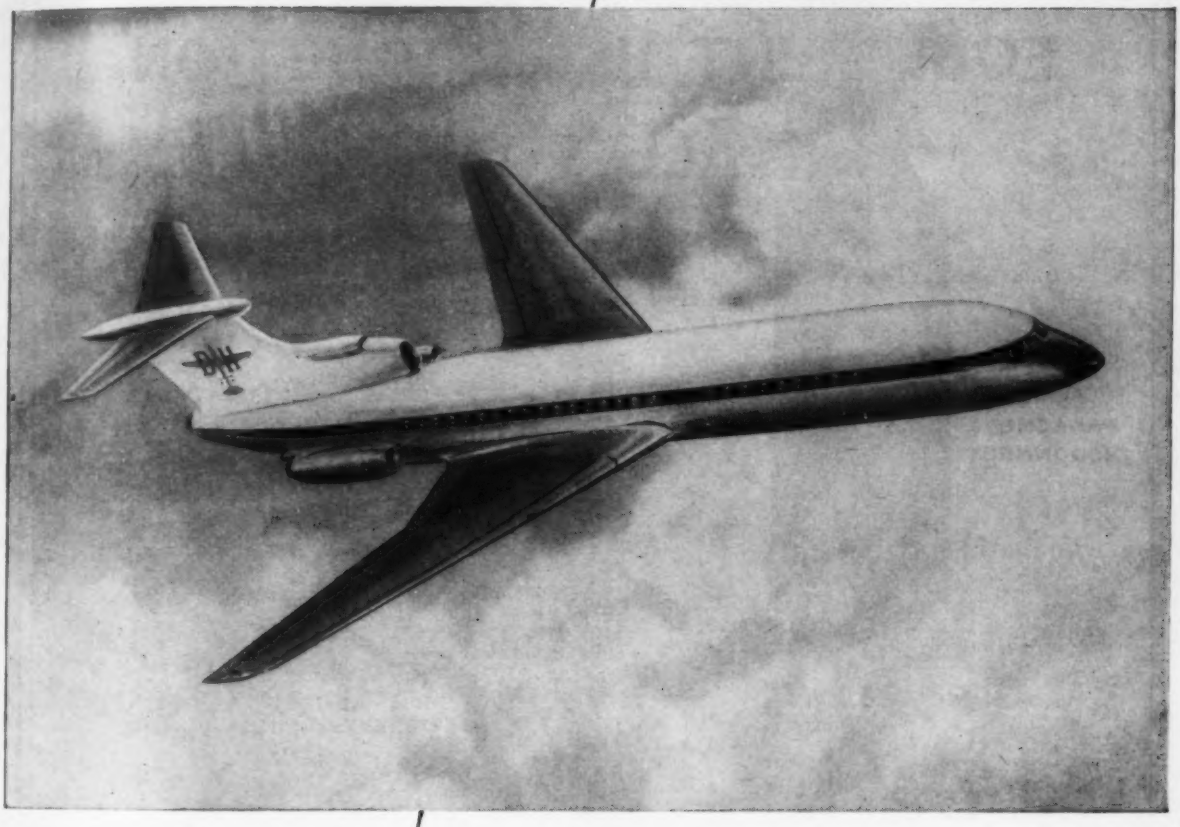
STAND No 30

at the Farnborough Air Show

HOBSON CONSTANT SPEED ALTERNATOR DRIVES

are now specified for the

D.H. TRIDENT JET AIRLINER



In this aircraft, described as the ultimate in subsonic speed combined with the best possible operating economy, the entire electrical generating capacity is dependent upon its constant speed drives, so that reliability and a long life between overhauls are of vital importance. Designed specifically for civil aircraft duties, HOBSON Constant Speed Alternator Drives achieve these essential qualities by their novel construction permitting the use of a transmission oil pressure of only 500 p.s.i. In addition, a unique pump off-loading system reduces the pump transmission pressure to 50 p.s.i. when the aircraft is cruising. The ingenuity and reliability inherent in this design also characterise the following additional HOBSON equipment now specified for the same aircraft:— FUEL BOOSTER PUMPS · FUEL FLOW PROPORTIONERS · TRAILING EDGE FLAP OPERATING SYSTEMS · LEADING EDGE DROOP OPERATING SYSTEMS

As Specialists in precision engineering, we invite your enquiries concerning projects to which our comprehensive engineering facilities can usefully be applied

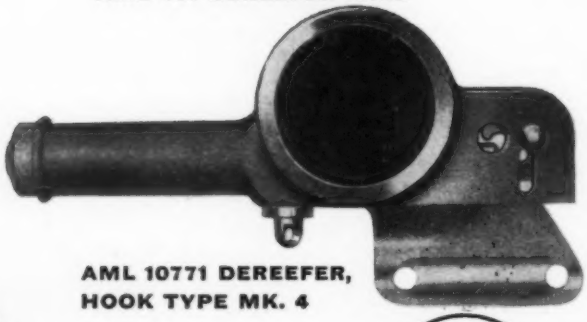
H · M **Hobson** *LIMITED · FORDHOUSES · WOLVERHAMPTON*

AIRBORNE AND OPERATIONAL EQUIPMENT IN PRODUCTION FOR ALL SERVICES

AML 286
PARACHUTE
DISCONNECT

AML 10414
LOCATION DEVICE

AML 431 DEREEFER MK.2



AML 10771 DEREEFER,
HOOK TYPE MK. 4

AML 10670
4 PT. QUICK RELEASE BOX

STAND 262

All equipment is designed to function under the most rigorous conditions.

The Quick Release Box AML 10670 which is impact and inertia proof is approved for use on all Escape Parachute Harnesses in the R.A.F. and Royal Navy.

Full details of all equipment and Harness Metal Fittings, Standard Parts, Metals, and 'Pop' Rivets are available on request.

AIRCRAFT MATERIALS LIMITED

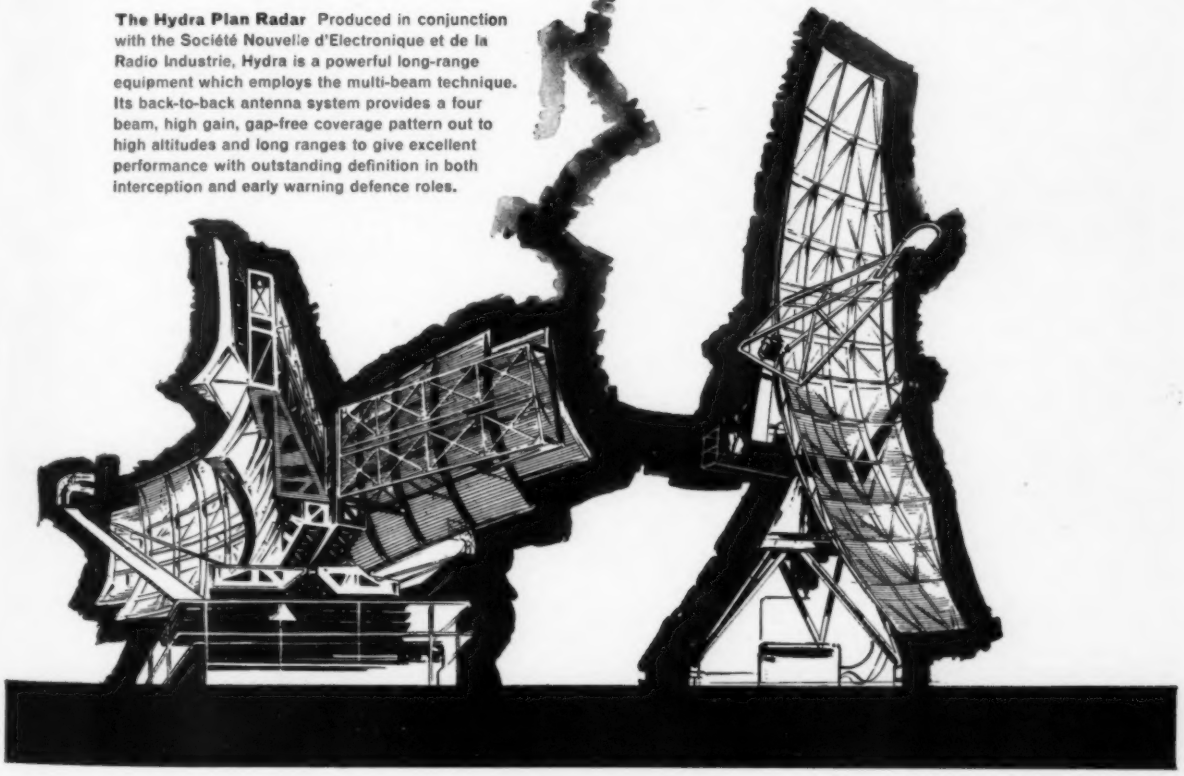
MIDLAND ROAD · LONDON · NW1 EUSton 6151 (10 LINES)

DECCA IN DEFENCE

radar cover at longer ranges

Heightfinder Type HF 200 Designed to meet the needs of high cover plan radars for heightfinders giving accurate information at high data rate throughout their coverage, Type HF 200 is an ideal complement to Hydra. The accurate equipment can be used with any long-range radar, and has a much faster operation and higher target handling capacity than any other heightfinder in its class.

The Hydra Plan Radar Produced in conjunction with the Société Nouvelle d'Electronique et de la Radio Industrie, Hydra is a powerful long-range equipment which employs the multi-beam technique. Its back-to-back antenna system provides a four beam, high gain, gap-free coverage pattern out to high altitudes and long ranges to give excellent performance with outstanding definition in both interception and early warning defence roles.



These two radars, now in production for the British Government, are among the most advanced in the world — outstanding examples of the progress of Decca Radar in the fields of early warning and height finding air surveillance systems. Their design and performance, the results of years of operational and development work, are such that they provide early and full defence warning against the most modern aircraft — including those known to be under development.

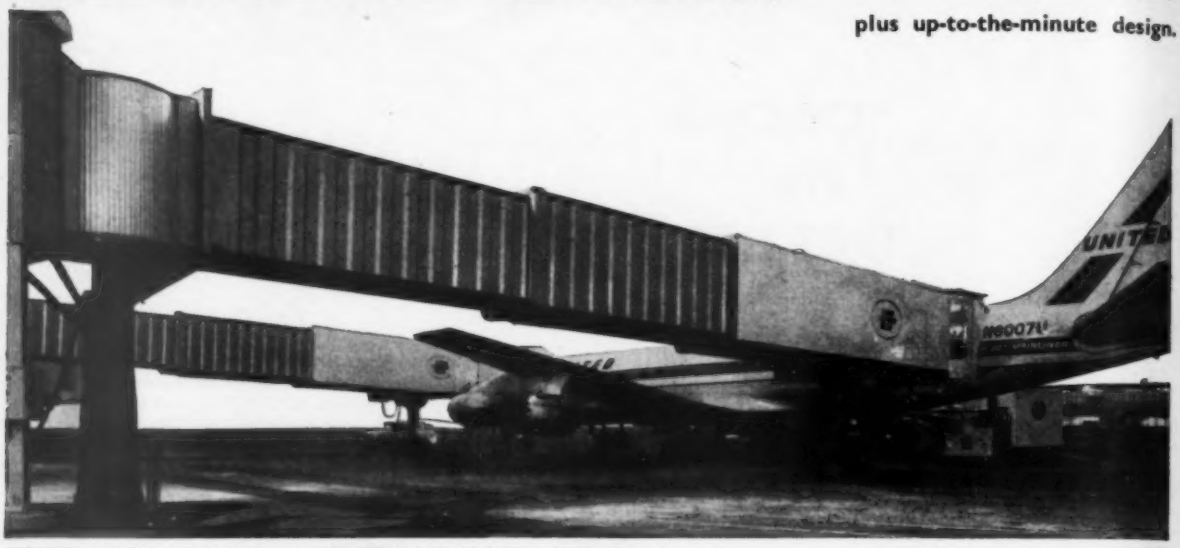
DECCA RADAR LIMITED · LONDON · ENGLAND

DECCA RADAR

DR171

MERCURY *LEADS!*

At airports all over the world MERCURY equipment is famous for rugged reliability plus up-to-the-minute design.

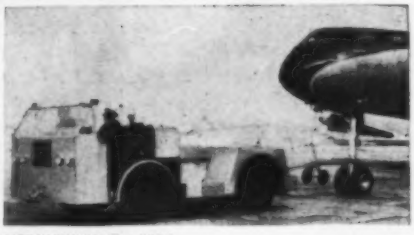


JETWAY manufactured under licence from STANRAY CORPORATION of America. Complete passenger protection from jet-blast, noise and weather; self-powered with positive traction wheels; one man operated from forward cab with unobstructed view; unit can be brought to aircraft in one minute; apron traffic moves freely underneath. JETWAY has become standard equipment in major American airports.

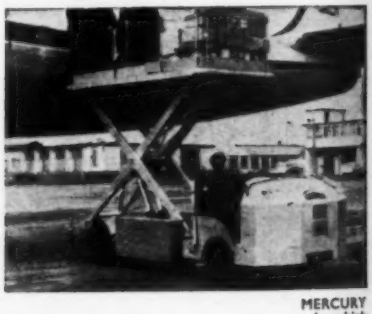
Rail-Drive Jetway.

SICARD Runway Sweeper.

MERCURY Multi-level Platform adjustable 7 ft. to 40 ft.



MERCURY Air Tug 160 L.



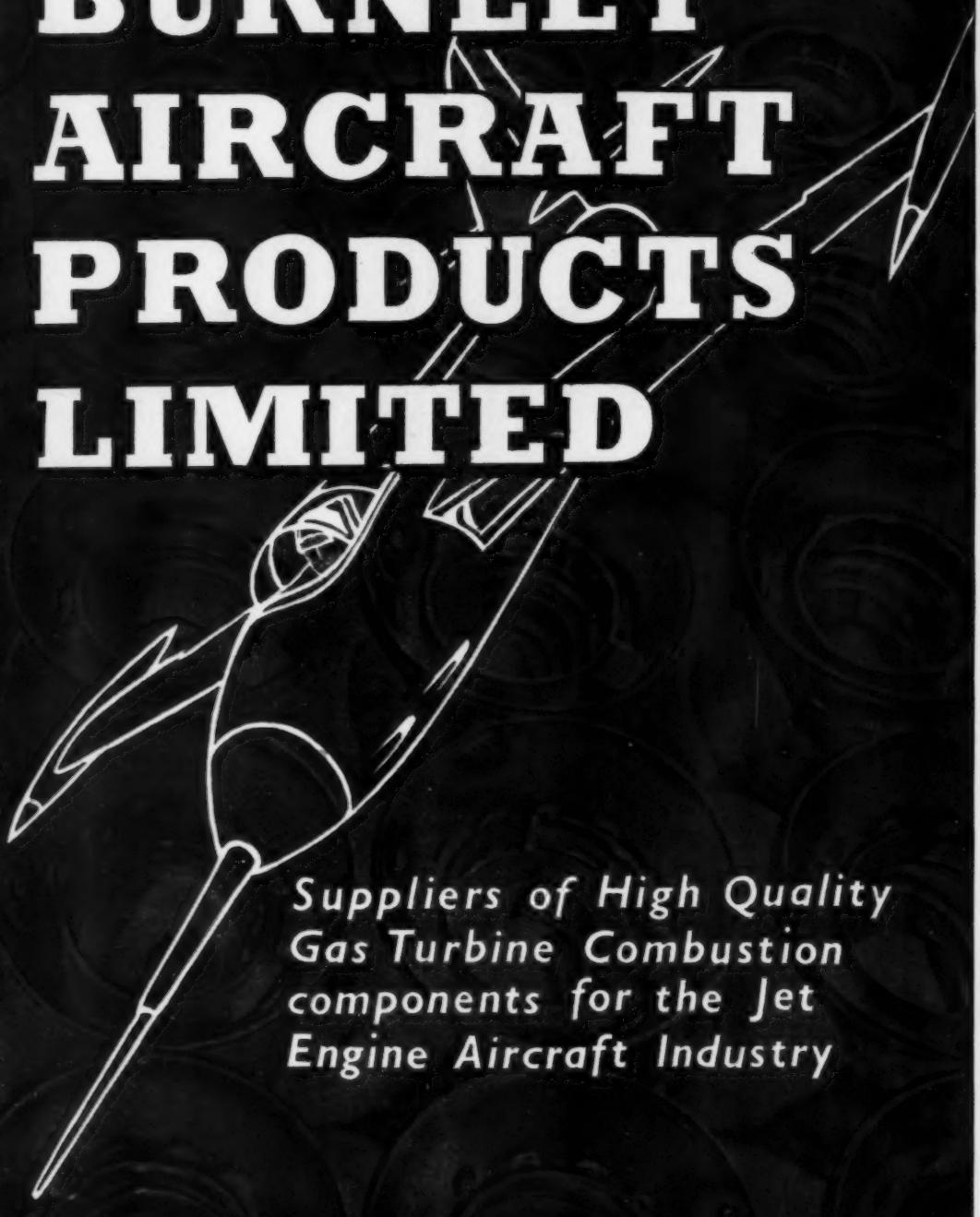
MERCURY Low-high Loader.

MERCURY 30 P Tractor and Baggage Trailers.

MERCURY

TRUCK & TRACTOR CO LTD
AIRFIELD EQUIPMENT LTD
The Quay · Gloucester · England
Telephone 24451

BURNLEY AIRCRAFT PRODUCTS LIMITED



Suppliers of High Quality Gas Turbine Combustion components for the Jet Engine Aircraft Industry

BURNLEY AIRCRAFT PRODUCTS LTD.

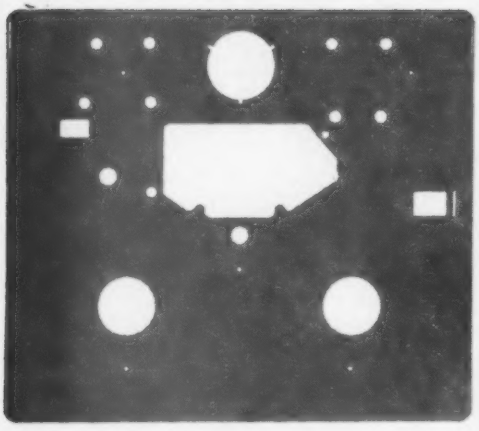
FULLEDGE WORKS - BURNLEY - LANCASHIRE - ENGLAND

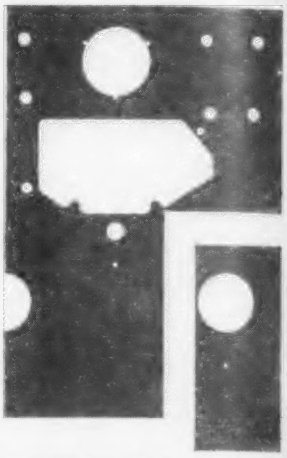
Telephone 7681 Burnley (5 lines) Telegrams: "AIRCRAFT" Burnley.

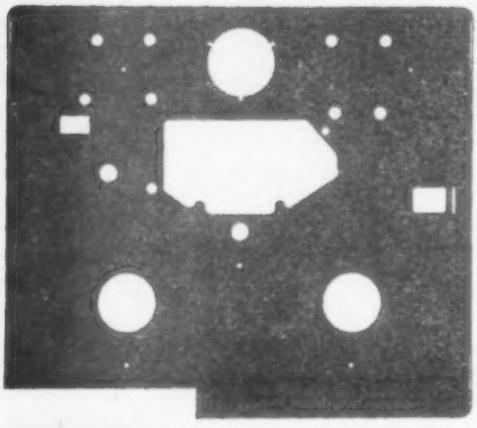
REPAIR DIVISION: BRITANNIA WORKS - QUEENSGATE - BURNLEY Telephone 4102.

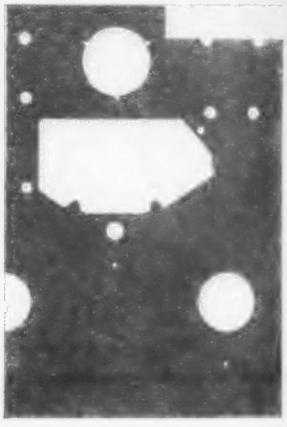
Associated with RENFREW AIRCRAFT & ENGINEERING CO. LTD., RENFREW, ONTARIO, CANADA.

T.I.P. TOP TOOLING NEWS





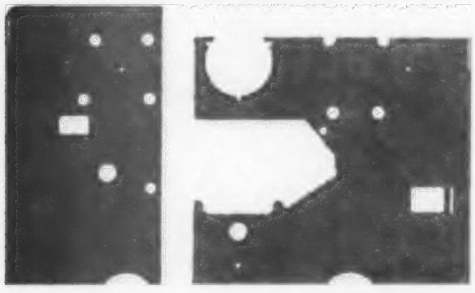


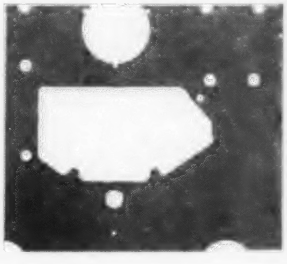


REYROLLE save up to 75% on press tools produced by T.I.P.

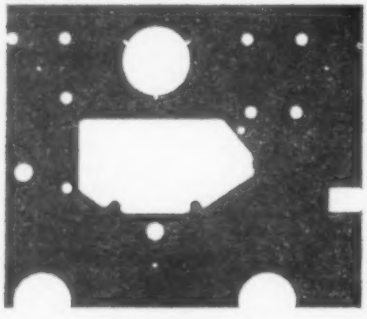
The majority of Reyrolle press tools are now made by the Templet Industrial Process, which has already caused 'a quiet industrial revolution' in America. This steel rule die system produces parts from metal or any other materials which are equal in quality to those produced by costly conventional tooling.

Yet T.I.P. dies cost so little to make that they can be used economically for blanking and piercing experimental and prototype parts. Blueprint-to-part times are reckoned in hours instead of days or weeks.





T.I.P. is available under LICENCE AND SERVICE AGREEMENT which provides for complete technical training in the manufacture and use of Templet dies.



See us on Stand No. 102 Farnborough Exhibition

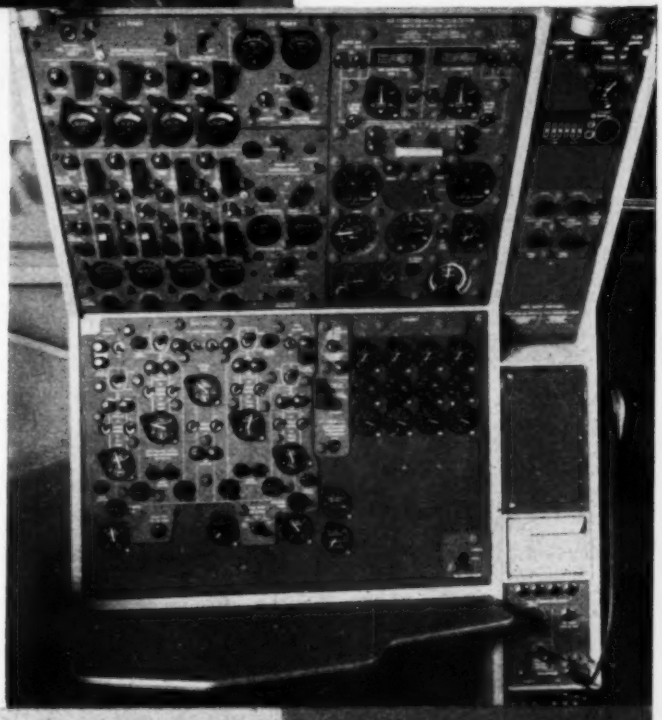
Write for full details from sole European Licensees

HORDERN-RICHMOND LIMITED • BRISTOL ROAD • GLOUCESTER • TEL 24941

GPS

Flight Deck of the G.P.S. BOEING B 720-048 Simulator

Close up view of the Engineer's Station G.P.S. BOEING B 720-048 Flight Simulator.



GENERAL PRECISION SYSTEMS

Electronic Flight Simulator to the BOEING B 720-048 configuration and performance.

Airlines, Air Forces and Government Authorities throughout the world have taken advantage of our experience in the design and manufacture of Flight Training Equipment.

Designers and Manufacturers of Electronic Flight Simulators, Flight Trainers, General Purpose Trainers.

S.B.A.C. Exhibition, Farnborough
4th - 10th September, 1961

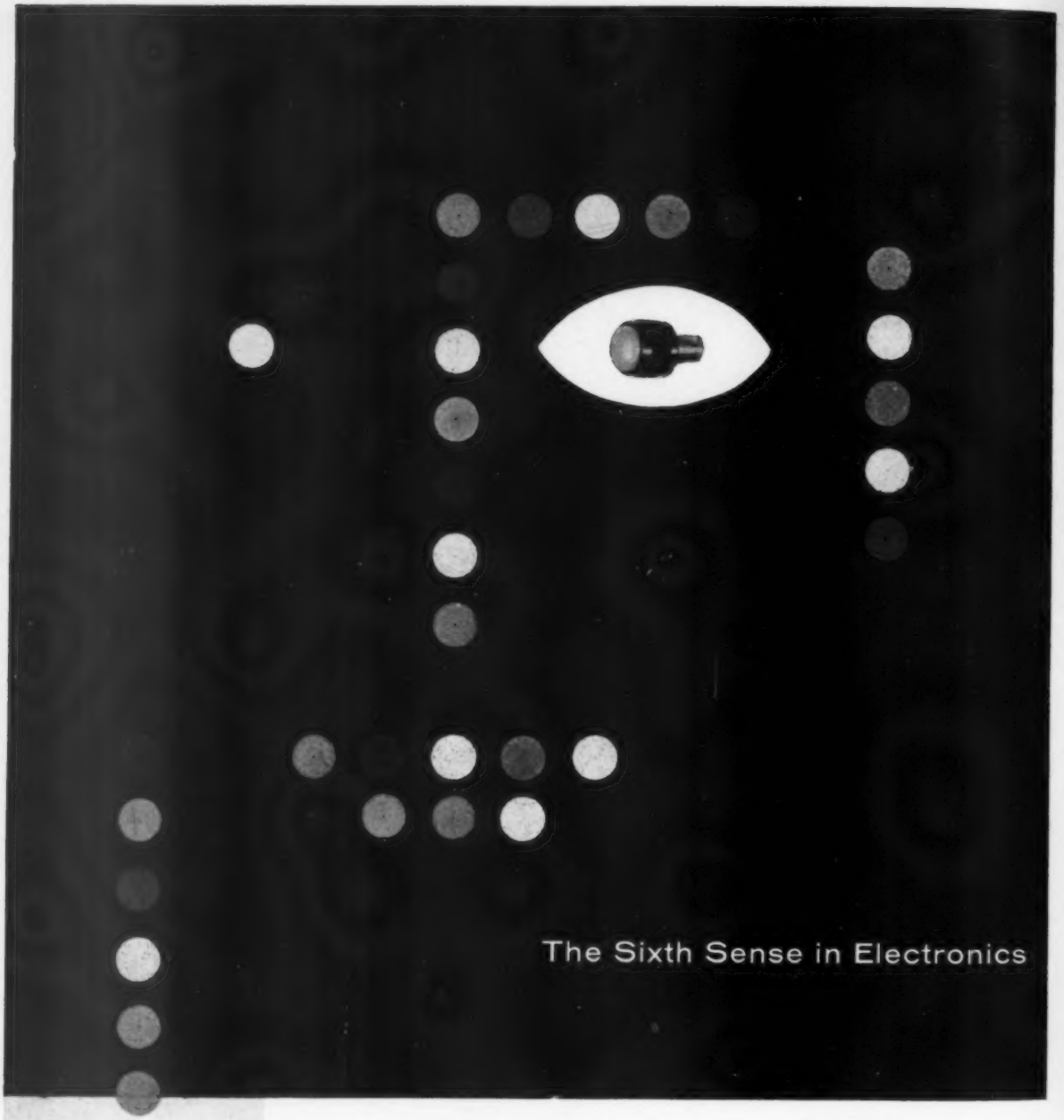
STAND
143
AIR SHOW 4171

GENERAL PRECISION SYSTEMS LIMITED

BICESTER ROAD, AYLESBURY, BUCKINGHAMSHIRE, ENGLAND

Telephone :- AYLESBURY 4611/7 "Telex" 83130

FLIGHT SAFETY FOUNDATION MEMBER



Visual indication of faults which may develop in aircraft and aircraft equipment is the only swift and sure method of detection.

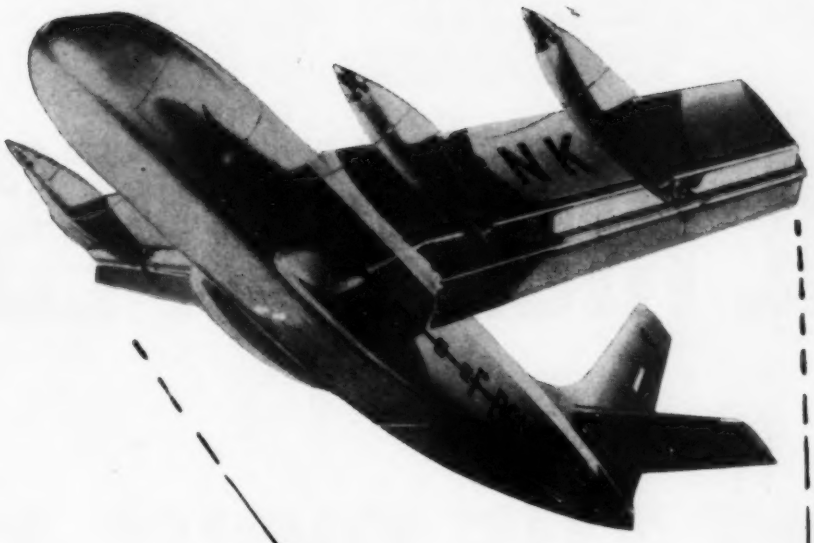
Page Engineering Company have designed, developed and put into service many visual centralised warning systems that are adaptable to all types of aircraft applications in which immediate fault warning for vital systems is an essential requirement.

We are also specialists in miniature electrical and electronic equipment for all aircraft and industrial applications.

Write for our Catalogue of relays, delay and switching units, push button and rotary switches, lamp holders for A.C. and D.C., indicating fuseholders, moving coil instruments etc.

PAGE

PAGE ENGINEERING COMPANY (Sunbury-on-Thames) LTD
Page Works, Forge Lane, Green Street, Sunbury-on-Thames, Middlesex
Telephone: Sunbury-on-Thames 4242 (3 lines)



Avion de transport moyen tonnage
à décollage et atterrissage courts

Charge marchande : 4 à 7 tonnes
Roulement au décollage et
à l'atterrissage : moins de 100 mètres
Vitesse de croisière : 400 km/h.

BREGUET 941

CATHODEON

THE RIGHT TYPES AT THE RIGHT TIME AT THE RIGHT PRICE

CATHODEON CRYSTALS LIMITED
LINTON CAMBRIDGESHIRE
TELEPHONE LINTON 501 (4 lines)

It's no Secret

that we hold large stocks of aluminium and aluminium alloys
in sheets, strips, bars, tubes, angles and extrusions of all kinds
to DGI and ARB specifications, and commercial grades too.

Everyone knows how helpful we are
and what a prompt and reliable service we have
to all parts of the country.

For aluminium ring Bowes Park 8431

W. Wilson & Sons (London) Ltd

Wilson Alloys Ltd-Sheringham Metals Ltd

114 Nightingale Road London N 22 Telephone: Bowes Park 8431 (ten lines)

WESTERN SERVE

THE AIRCRAFT INDUSTRY

Western's service to the Industry ranges from the supply of aircraft accessory equipment to the manufacture of aircraft fuselages and air frame structures
Whatever the problem — electrical or electronic, pneumatic or hydraulic, thermal or mechanical — Western's have the experience and the facilities to solve it

WESTERN

WESTERN MANUFACTURING (READING) LTD
THE AERODROME, READING, BERKSHIRE, ENGLAND TELEPHONE: SONNING 2351 TELEGRAMS: HAWK READING

In the field of sub-contract manufacture, Western's are privileged to serve the most important aircraft companies

Meet the Western Engineers on
Stand No. 6 at the S.B.A.C Exhibition

Off to a good start . . .

Aircraft can always get off to a good start with the aid of a Murex Ground Power Unit. These diesel engine-driven equipments are designed to supply instant and reliable power for the starting and servicing of a wide range of piston, turbojet and turboprop aircraft and they are used by leading operators and manufacturers throughout the world. Special models can be supplied to meet individual requirements, but standard equipments are designed to provide a peak load of 2,000 amperes for engine starting and a current of 600 amperes continuously at 28 volts for servicing and pre-flight checks. Please write for full details.

MUREX

GROUND POWER UNITS for aircraft starting and servicing

MUREX WELDING PROCESSES LTD., WALTHAM CROSS, HERTS

GPU.45/379

You'll do a great deal better
with Polish made
PZL-101 GAWRON agricultural aircraft
PZL-102B KOS two-seat touring aircraft

Sailplanes:

BOCIAN—high performance two-seater

LIS—high performance single-seater sailplane

ZEFIR—high performance single-seater sailplane

FOKA-STANDARD—performance single-seater sailplane in the Standard Class

Helicopters SM-1W:

—liaison-ambulance version

—agricultural version

—training version

Aircraft instruments

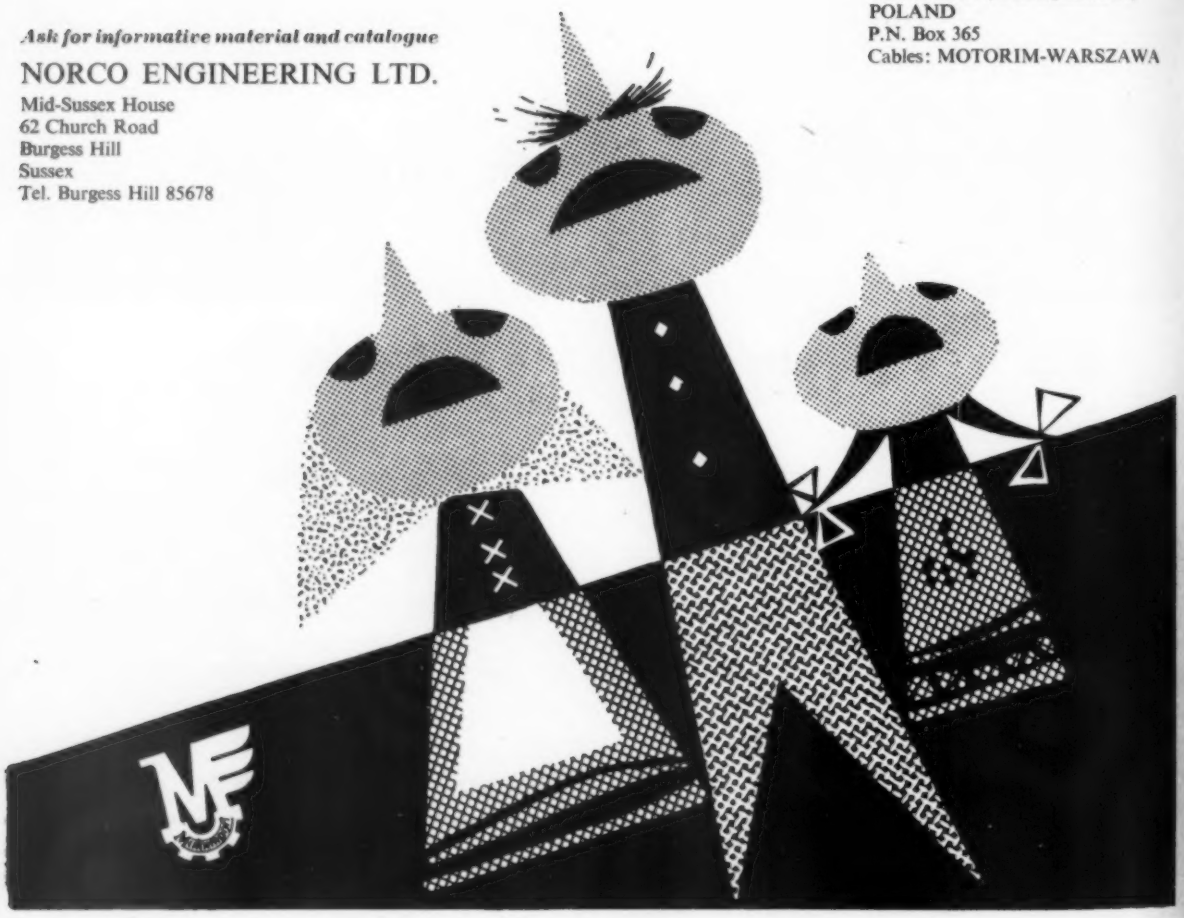
PZL-102B 'KOS'

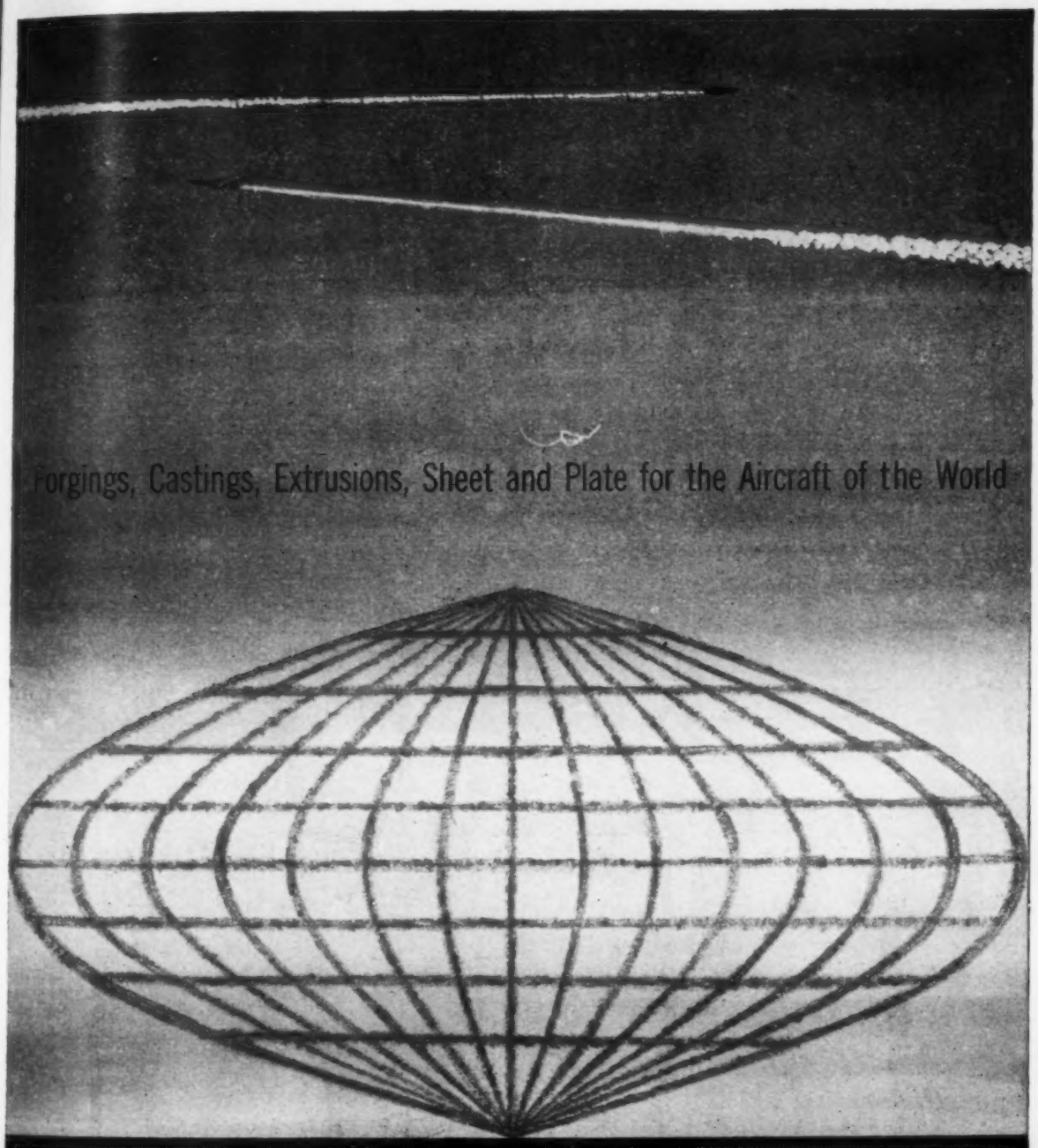
Exporter:

MOTOIMPORT
FOREIGN TRADE ENTERPRISE
WARSZAWA, Przemysłowa 26,
POLAND
P.N. Box 365
Cables: MOTORIM-WARSZAWA

Ask for informative material and catalogue

NORCO ENGINEERING LTD.
Mid-Sussex House
62 Church Road
Burgess Hill
Sussex
Tel. Burgess Hill 85678





H.D.A. make special forgings in all metals and aluminium alloy castings, extrusions, tube, plate and sheet — not only for every British aircraft but for many of those designed and built in other countries.

HDA

HIGH DUTY ALLOYS LTD · SLOUGH · BUCKS

For the first time England to Australia non-stop . . . by Avro Vulcan

HAWKER SIDDELEY AVIATION

32, Duke St., St. James's, London S.W.1

No 2739 VOLUME 80 THURSDAY 7 SEPTEMBER 1961

FLIGHT

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded in 1909

Editor-in-Chief
MAURICE A. SMITH DFC

Editor
H. F. KING MBE

Technical Editor
W. T. GUNSTON

Air Transport Editor
J. M. RAMSDEN

Production Editor
ROY CASEY

Managing Director
H. N. PRIAULX MBE

IN THIS ISSUE

From All Quarters 360
Air Commerce 362
Missiles and Spaceflight 363
Sport and Business 364
Twenty-second SBAC Show 365
Development and Demonstration 377
The Flying-display Pilots 387
Canadair CL-41 in the Air 391
Ready for Show 393
Scampton's Vulcan B.2s 394
VTOL Propulsion 396
Rockford Fly-in 398
Straight and Level 400
Service Aviation 408
Correspondence 409

Iliffe Transport Publications Ltd, Dorset House, Stamford Street, London, SE1; telephone Waterloo 3333. Telegrams Flightpres London SE1. Annual subscriptions: Home £4 15s. Overseas £5. Canada and USA $15.00. Second Class Mail privileges authorized at New York, NY.

Branch Offices Coventry: 8-10 Corporation Street; telephone Coventry 25210. Birmingham: King Edward House, New Street, 2; telephone Midland 7191. Manchester: 260 Deansgate 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow: 62 Buchanan Street C1; telephone Central 1265-6.

New York, NY: Thomas Skinner & Co (Publishers) Ltd, 111 Broadway 6; telephone Digby 9-1197.

© Iliffe Transport Publications Ltd, 1961. Permission to reproduce illustrations and letterpress can be granted only under written agreement. Brief extracts or comments may be made with due acknowledgement.

Brown Jobs

THIS year's SBAC Display has a robust Army accent. Not only is it the first occasion on which the Army has made an individual contribution to the flying display programme, but that same Service is given precedence over the other two in order of appearance. Among the brand-new aircraft demonstrated, moreover, is Beagle Auster's Mark 11 air observation post, which has a zero-wind take-off run of less than a hundred yards and can land in less than seventy. There are square-bashing manœuvres by four Westland Skeeters, and parachutists of the Special Air Service are putting on a spectacular drop from 7,000ft. After falling free from 5,000ft they open their parachutes and steer themselves on to a pre-determined spot. The RAF, of course, are in the free-falling business also, as a spectacular picture on page 283 of last week's issue bore witness.

Thus increasingly does the SBAC Display take on the former spectacles and thrills not only of Hendon but of Aldershot, Woolwich and Tidworth.

A Question of Appeal

EVERY major decision of the Air Transport Licensing Board is likely to be disputed before an appeals commissioner. The appeals machinery is therefore likely to be a crucial element in the whole system of licensing British air transport. This machinery was recently put to its first test; the appellant was Falcon Airways, the opposing party was BEA, and the commissioner was Sir Leonard Stone. The hearing is briefly summarized on page 402.

That the machine itself is poorly designed is something about which nobody can now do very much. So a great deal depends on the man in charge—the appeals commissioner. He must be a man who decides, without being too legalistic, whether the Board has interpreted the law correctly. He must also assess any new evidence and decide whether it might affect the issue. To do this he need not necessarily be an air transport expert; after all, learned judges are trained to grasp the essentials of technical subjects. The commissioner must see whether the laws of natural justice have been observed, and in doing so he must bear in mind that the ATLB is not a court of law, but an administrative tribunal, with a very wide discretion, which has to work fast.

Whatever may have been said about the members of the Board when they were appointed, they now have some 300 cases behind them and they comprise experts in accountancy, economics, the travel industry and transport, as well as in civil aviation. The commissioner cannot possibly possess their accumulated knowledge; so he must assess whether it is *reasonable* that the Board should have decided as it did. Unfortunately, Sir Leonard Stone's handling of this first—and admittedly difficult—case tended to be too legalistic.

The appeals machinery itself may be poorly designed, but the industry has to live with it. Because it is a machine upon which so much will depend, it will have to be handled in future in a less forensic manner. No harm would be done if the appeal commissioner's aim were to try to achieve that "air of reasonable informality" so admirably attained by Professor Jack as chairman of the Air Transport Licensing Board.

FROM ALL QUARTERS

Anglo-American Conference Opens

THE eighth Anglo-American Aeronautical Conference, organized by the Royal Aeronautical Society, the Institute of the Aerospace Sciences and the Canadian Aeronautical Institute, began on Sunday last with a reception for delegates and their wives given by the RAeS president, Air Marshal Sir Owen Jones, and Council at the Society's London headquarters. Visits to aircraft and engine companies and to the SBAC Show were due to be made this week.

On Monday next the technical sessions of the conference will begin in the Society's new lecture hall. These will continue for four days and will include 15 papers (seven US, six British and two Canadian) devoted to the subjects of space technology, supersonic transports and vertical take-off and landing aircraft. The meeting is unusual in comparison with most contemporary conferences in the small number of papers presented and the absence of simultaneous sessions. It has been considered an advantage that all delegates can, if they wish, attend all the lectures and discussions.

Although not officially a part of the conference, an important associated event during next week is the Society's Wilbur Wright Memorial Lecture, to be presented at 7 p.m. on Tuesday, September 12 in the RAeS lecture hall by Dr Abe Silverstein, Director of Space Flight Programs of the National Aeronautics and Space Administration. Dr Silverstein's paper, the presentation of which is to be followed by a reception at the Society, is devoted to "Researches in Space Flight Technology."

Vickers Hovercraft: New Details

FOLLOWING tests with a small research ground-effect machine, two further types are now under construction by Vickers-Armstrongs (South Marston) Ltd, in conjunction with Hovercraft Development Ltd, and a larger machine is being designed. A large amount of advanced scheming has been in hand at South Marston on hovercraft of the deep-sea-going type.

To follow up an extensive series of model tests, research hovercraft VA-1 was built, fitted with bare essentials only for initial overland tests. This machine became operational in 1960 at a weight of 3,300lb and a hover-height of 4½in. It has been operated continuously since that time, with various modifications including several different lift-curtain systems. Stability devices such as compartmentation of the cushion and associated controls have also been developed. Fairings and a cabin have been added as protection for overwater trials, and these modifications have increased the weight to 3,500lb with a hover-height of 4.1in.

For demonstration purposes, the company went on to design a second vehicle, small enough to be air-freighted to overseas sites and sufficiently developed to prove the engineering design and the practicability of application. This machine, the VA-2, is now under construction. With a speed of 40kt and an endurance of 1½hr, this utility craft will be capable of carrying four or five people. In addition to demonstrations and route assessments, the machine would have an immediate application "as a fast executive transport over sheltered and inland waters and for the transport of personnel and equipment over difficult terrain where existing types of vehicle cannot operate."

For ease of loading into current British transport aircraft, three sections on either side of the main structure will be readily detachable, together with the two fin and rudder assemblies and the complete propulsion unit with support struts. Powered by three light-aircraft piston engines (two for lift and one for propulsion), the machine has a hover-height over a solid surface of 8½in. It is 28ft long, 14ft 10in wide and 10ft 4in high.

A ten-ton version, the VA-3, is also now under construction. Operating in river estuaries, over water with waves up to 2ft, over shoals and mudbanks, the craft will be able to carry 24 passengers and crew in the passenger-ferry role; or, for survey, exploration or patrol, would carry some 4,000lb of equipment plus crew for 80 n.m. at high speed. Four 360 h.p. Blackburn Turmos are specified for the lift fans and propulsion drives, but the design is sufficiently flexible to permit the use of alternative powerplants.

For the propulsion system, two reversible, variable-pitch, four-bladed propellers are used. The pitch-change provides reverse thrust which is used for braking the craft and to aid manœuvrability. In addition to the directional control provided by the propulsion system, cable-operated control surfaces on the port and starboard coamings provide effective keel area to prevent drift and assist turning. Length of the VA-3 is 52ft 6in, width 25ft and height 17ft 9in.

For the future, the company is working on a number of short-haul, passenger-car ferry designs. One of these is the VA-4, weighing 110 tons and capable of speeds between 70 and 80kt with a hover-height of 3ft. Length is 173ft, beam 58ft, equipped weight 61 tons and fuel and payload 49 tons. To improve manœuvrability in restricted waterways the propulsion engines are mounted amidships and given mechanical means of deflecting thrust. The bows and sidewalls and the air-cushion configuration are suited to the expected waves, floating debris or solid obstacles likely to be encountered. Vickers-Armstrongs (South Marston) are not members of British Aircraft Corporation, nor of the SBAC.

Jacqueline Cochran's 842.6 m.p.h.

IN a Northrop T-38 Talon jet trainer last week Miss Jacqueline Cochran achieved a speed of 842.6 m.p.h. over a 9.3-mile course at Edwards AFB, Cal. She thus exceeded the international women's air speed record set up in 1955 by Mlle Jacqueline Auriol of France, who flew a Mystère over a 26-mile course at more than 715 m.p.h.

WHITE PIRATE: Now finished in the white anti-flash colour scheme for nuclear-armed aircraft, this Blackburn Buccaneer S.1 was recently demonstrated before German officers at Jagel

CIVIL AND MILITARY applications are foreseen for this turboprop-powered Kamov convertiplane, first seen at Tushino a few weeks ago. One report mentions seating for 80-100 passengers

THE BLUE DIAMONDS, alias No 92 Sqn, RAF Fighter Command, rehearsing their new formation, the "Diamond T," near their base at Leconfield, Yorks

If her speed is ratified by the FAI—of which body she is past-president—Miss Cochran will become the holder of this world record for the second time.

High-wire Accident

IN an accident caused when a French Air Force F-84F Thunderstreak struck the cable of the cable railway between Aiguille du Midi and the Ponte Berlbronner near Mt Blanc on Tuesday of last week, six people lost their lives; 81 others left dangling in the cars were subsequently rescued.

The accident was the second of its kind: in the summer of 1959 a French civil helicopter struck the cable railway over the Vallée Blanche. The cable system struck by the Thunderstreak is the highest in the world, over 12,000ft. French Air Force helicopters assisted in rescue operations. Pilot of the Thunderstreak, Capt Bernard Ziegler, was later stated by the French Ministry of the Armed Forces to have been flying on a "safe" route.

September 16 Displays

AEROBATICS by formation teams and by solo performers will be the order of the day at many of the Battle of Britain displays being held on September 16, when sixteen RAF stations (listed in *Flight* for April 20) will be open to the public. The 92 Sqn team, "The Blue Diamonds," are giving shows at Gaydon, Biggin Hill and Waterbeach; the 74 Sqn Lightning team is appearing at Biggin Hill; and individual Lightnings are performing at Abingdon, Waterbeach, Waddington, Finningley and Cottesmore. Biggin Hill will also have a visit from the four CFS Jet Provosts, who are later appearing at Tangmere. Four Hunters, from No 229 OCU, are giving shows at St Athan and their home base, Chivenor; and amongst other performers are Vampires from 1 FTS and Jet Provosts from 1 and 2 FTS, who will be at Leuchars and Middleton St George.

IN BRIEF

MoA have announced that Dr G. G. Macfarlane, at present Deputy Director of the National Physical Laboratory of the DSIR, is to be Director of the Royal Radar Establishment at Malvern. He will take up his new duties in the early part of next year.

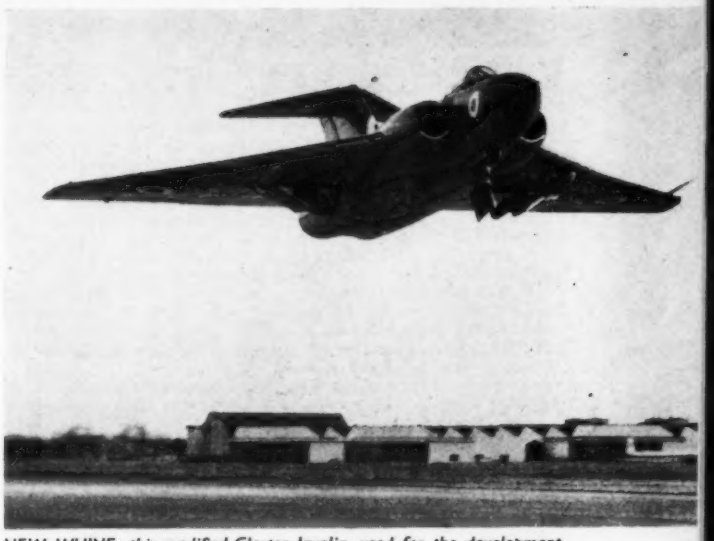
Four Lockheed F-104C Starfighters of the USAF recently made a 2,300-mile trans-Pacific crossing to Hawaii, the longest over-water flight ever made by these aircraft. They took off from George AFB, Victorville, Cal.

The RNZAF have ordered 37-tube Microcell glass-fibre rocket launchers for their B(I).12 Canberras. Discussions begun at the Paris show about the adoption of Microcell launchers as NATO equipment are being continued at Farnborough.

The US Navy have claimed as a new ow-level (below 328ft) record a speed of 902.769 m.p.h. set up by a McDonnell Phantom II over White Sands, New Mexico, on Monday of last week. Existing record is 752.94 m.p.h.

The first of the 50 Lockheed C-130E Airlifter transports to be ordered by MATS flew from Marietta on August 25. This new long-range derivative of the Hercules can carry 100,000lb cargo over stages up to 1,000 miles, or 34,000lb from the US to West Germany. Service is scheduled for next March.

Operating under Napier licence, Pacific Airmotive Corporation, of Hollywood, have won new orders worth about $1m (£357,000) for Spraymat anti-icing elements for European Lockheed F-104G engine intakes. Deliveries will be made to Fiat, Siebelwerke and Westfalische Metall Industrie.



NEW WHINE: this modified Gloster Javelin, used for the development of supersonic D.H. Gyron Junior DG].10 engines for the Bristol T.188 all-steel research aircraft, is—like the Hunters above—performing all week at the SBAC Show, flown by Peter Barlow

British Aircraft Corporation and the American Minneapolis-Honeywell Regulator Co have formed a new joint organization to develop, manufacture and market in Europe inertial guidance systems for aircraft and missiles. The new organization, Inertial Guidance—Europe, will have headquarters in Paris.

FALL GUYS: Six instructors from the RAF's No 1 Parachute Training School, Abingdon, who are demonstrating free-fall jumping during the SBAC Display. The display report opens on page 365

AIR COMMERCE

Seen taking off from Montreal is a Canadair CL-44 of Flying Tiger Line. About five have been delivered to this all-freight carrier and are at present operating US domestic scheduled freight services and MATS charters across the Pacific

PROCEEDINGS AGAINST FALCON—

SEVEN summonses alleging contravention of the Civil Aviation Act, 1949, or the Air Navigation Order, 1960, have been issued against Falcon Airways and Capt M. Kozubski, managing director. They were due to be heard at Bournemouth magistrates court yesterday, September 6.

The summonses are the outcome of an eight-week Ministry of Aviation enquiry into a transatlantic flight by Capt Kozubski on March 30. The summonses concern navigation equipment and the serviceability of the radio equipment carried. One alleges than an insufficient number of dinghies were on board.

—AND AGAINST OVERSEAS

BANKRUPTCY proceedings against Overseas Aviation (CI) Ltd, the Jersey-registered company of Mr Ronald Myhill, were instituted at Jersey Royal Court on August 26. The action was brought by Mr B. Bisson on behalf of WAAC (Nigeria) Ltd, presumably for outstanding commitments on three Herons purchased earlier in the year. The court was told that there were no assets in the Island and no money in the bank.

According to a notice in the *London Gazette* of August 25 the date for the hearing of the petition for the compulsory winding up of Overseas Aviation (CI) Ltd is October 9. The petition was presented on August 17 by BP Trading Ltd and Rolls-Royce, and the hearing will take place at the Royal Courts of Justice, Strand, WC2.

The 200 engineers employed by Overseas Aviation Engineering (GB) Ltd stopped work on August 22 after sending an ultimatum to Mr Myhill demanding to know what their future was. Sheriff's officers moved into the Gatwick hangar of the grounded airline on August 25 and took furniture away.

It is reported that Mr H. Snowball, managing director of Airborne Aviation Services (Gatwick), has agreed terms, subject to contract, for the purchase of the Overseas Aviation Engineering (GB) Ltd hangar at Gatwick. Price is not disclosed; when the hangar was opened in the summer of last year cost was said to be £300,000 (*Flight*, June 24, 1960, page 881). BUA have also been bidding for this hangar, which borders their Gatwick base.

MELBOURNE AND THE JETS

THE Australian Government's decision not to allocate any Federal funds in the 1961–62 budget for construction of a jet airport for Melbourne has proved very unpopular with that city. More than £2m has already been spent in land reclamation at Tullamarine, site of the new jet airport some three miles from Essendon, and about 5,000 acres are being reclaimed from private ownership. Otherwise little progress has been made, although plans for the airport have been on paper for at least two years. Senator Paltridge, Australian Minister for Civil Aviation, issued a press statement that the Government was conscious of Melbourne's needs but was awaiting a decision by Ansett-ANA and TAA on the jets they would order. But the latter's choice of jets will be considerably affected by a decision on Tullamarine and by the Government's attitude to any differences of opinion between Ansett-ANA and TAA in the types of jets they want.

Mr Ansett has now accepted the fact that the Boeing 727, which (according to an Australian correspondent) he has pretty well decided in theory to order, would not be permitted to operate at Essendon, which is being badly damaged and broken up even by Electras. First 727 deliveries to Ansett would therefore have to coincide with the opening of Tullamarine. TAA are nothing like so definite, but they like the Caravelle 7 (the only version of the Caravelle they would buy) and are "very respectful" about the 727 and Trident. Both carriers assume that they will be permitted to have two types of jet each, and Mr Ansett is thinking in terms of the 727 and BAC One-Eleven. As the BAC-107 (which both Ansett and TAA are said to prefer) is evidently shelved for a considerable period, the BAC One-Eleven would appear to be "well in the picture." The One-Eleven has the advantage that it is being offered with special 87 psi low-pressure tyres which would make it suitable for operating into Essendon if noise objections can be overcome. Ansett-ANA and TAA are now thinking in terms of getting One-Elevens to operate for a short time into Essendon prior to the opening of Tullamarine in, say, 1965.

FRIENDSHIPS FOR EAAC AND DTA

EAST AFRICAN AIRWAYS, as already reported, is to buy three Fokker Friendships to replace some of its nine DC-3s and three Canadair DC-4Ms on regional routes. In a press statement EAAC said that it "is seeking guarantees for the finance involved in an initial order for three Friendships to be delivered by the end of 1962." A repeat order for a further seven Friendships may eventually be placed. East African Airways thus becomes the twelfth Commonwealth airline to order Friendships. The other ten are Ansett-ANA, Airlines of NSW, Airlines of South Australia, Queensland Airlines, East-West Airlines, Mac.Robertson Miller Airlines, NZNAC, TAA, Indian Airlines Corporation and Pakistan International Airlines.

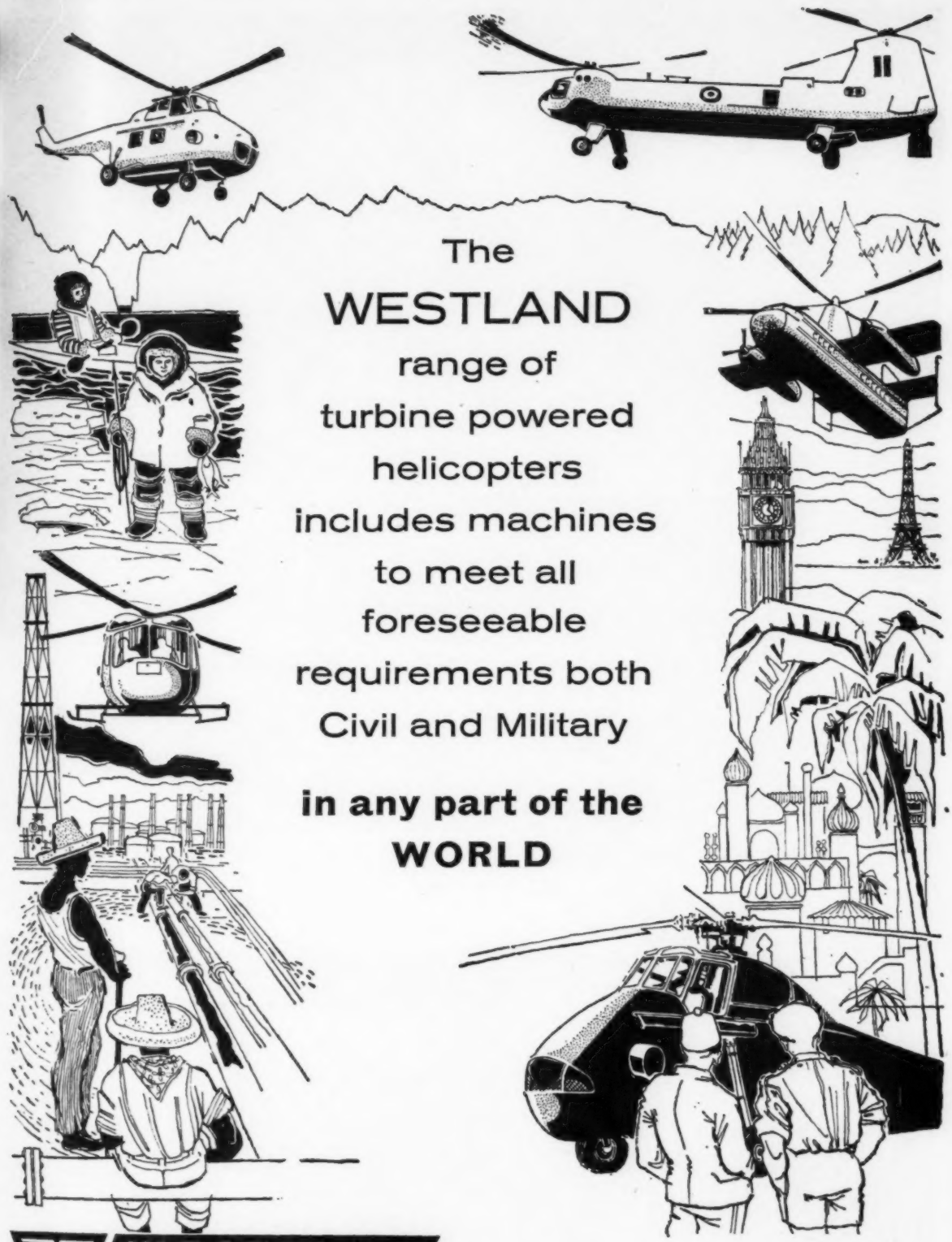
Following the recently announced order for three Friendships from DETA of Mozambique, its sister airline in Angola, DTA (Divisao de Exploracao dos Transportes Aereos) has ordered two Friendship Series 200s for delivery in the second half of 1962. DTA operates over an unduplicated route network of 3,300 miles with seven DC-3s, four Beechcraft 18s and three Rapides. DTA is the third African carrier to place a firm order for Friendships; Sudan Airways has three on order and DETA three. A total of 102 Friendships has now been sold by Fokker. Nigeria Airways are understood to be considering the purchase of seven Friendships.

FIGHT FOR SHOBDEN

IN a fight to save Shobden airfield, 20 miles north-west of Hereford, from being sold as farmland, the Herefordshire Aero Club, 26 High Street, Leominster, is conducting a survey to assess the potential use of the airfield. The Herefordshire County Council has agreed to reconsider the purchase of Shobden as a civil airport, provided it appears to be a good investment. Shobden is the only airfield in the area suitable for civil use, and questionnaires have been circulated by the club to local firms, residents and members of the Business Aircraft Users Association.

According to the Herefordshire Aero Club there are several airlines interested in operating services from Shobden. Results of their survey will be passed to the airlines and to a County Council committee.

("Air Commerce" news is continued on page 401)



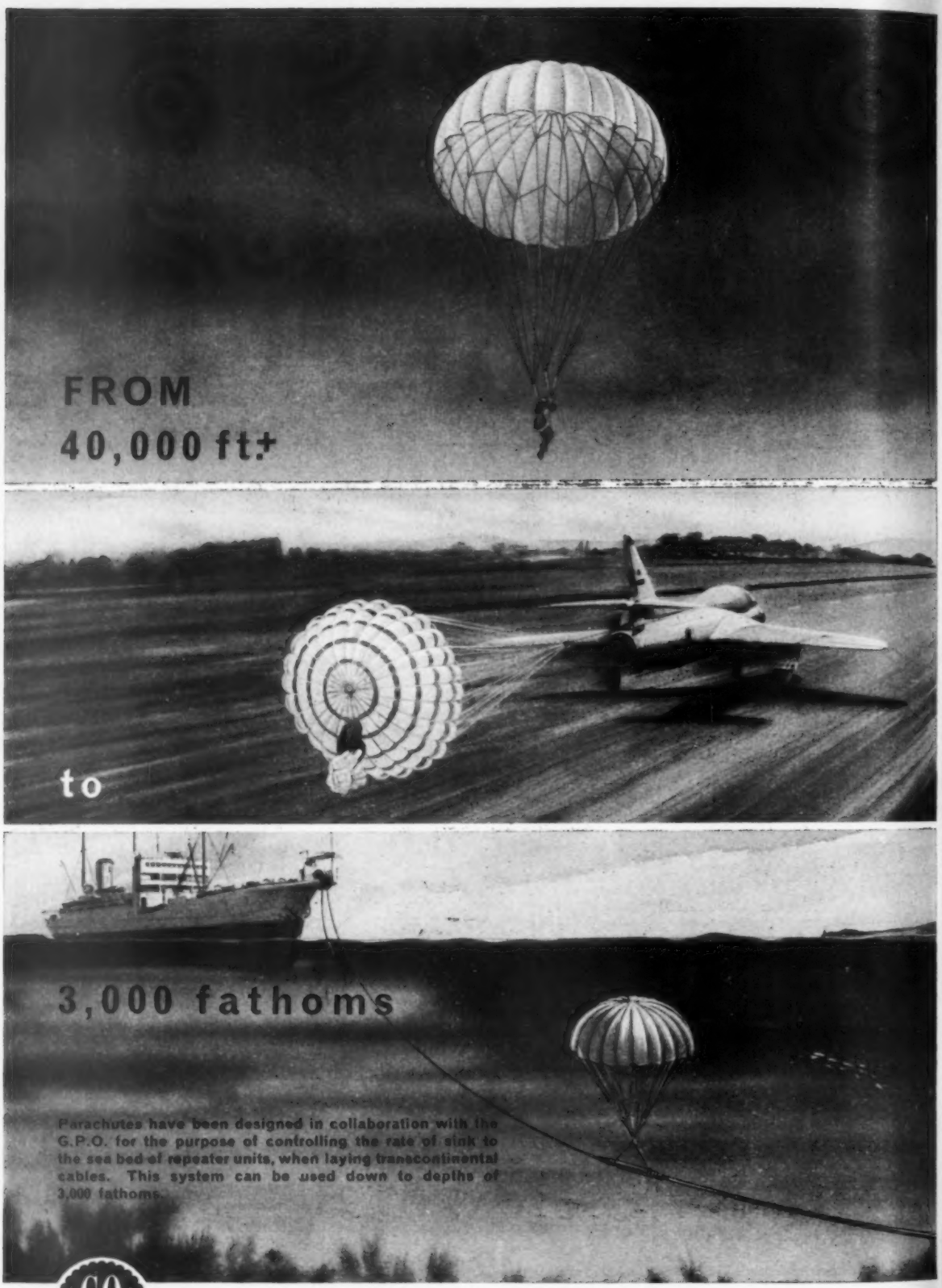
The
WESTLAND
range of
turbine powered
helicopters
includes machines
to meet all
foreseeable
requirements both
Civil and Military

in any part of the WORLD

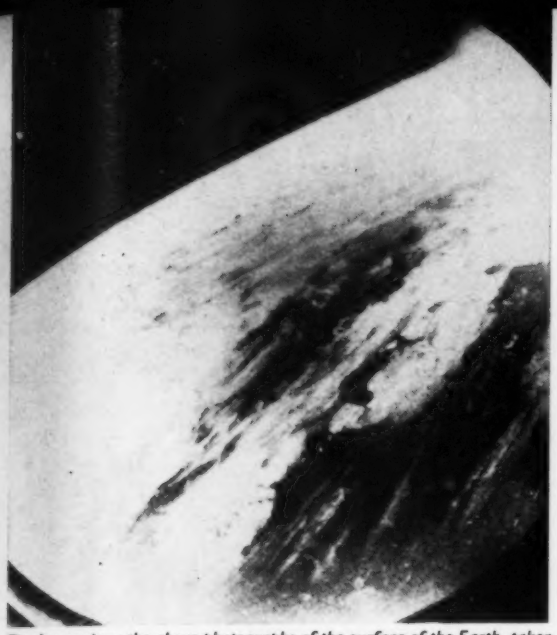
WESTLAND *the great name in HELICOPTERS*

WESTLAND AIRCRAFT LIMITED YEOVIL ENGLAND

Incorporating SAUNDERS-ROE DIVISION, BRISTOL HELICOPTER DIVISION and FAIREY AVIATION DIVISION


FROM
40,000 ft.+
to
3,000 fathoms
Parachutes have been designed in collaboration with the G.P.O. for the purpose of controlling the rate of sink to the sea bed of repeater units, when laying transcontinental cables. This system can be used down to depths of 3,000 fathoms.

G. Q. PARACHUTE COMPANY LIMITED
STADIUM WORKS · WOKING · SURREY · ENGLAND



Titov's-eye view: the above photographs of the surface of the Earth, taken by Maj Herman Titov while in orbit in "Vostok 2," were released by Tass on August 29. Right, looking through the porthole of the optical orientation instrument aboard the spacecraft

Missiles and Spaceflight

EXPLORER 12 HARD AT WORK

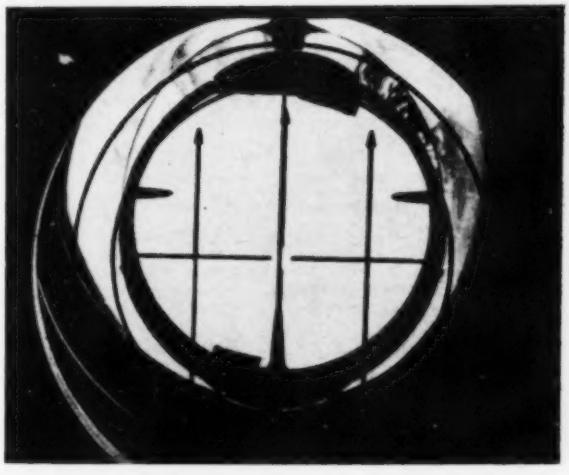
An embarrassingly large amount of information was transmitted continuously by the instruments aboard Explorer 12, the energetic-particles satellite launched into orbit on August 15, during the two weeks following that date. Periodic acquisition of data by ground stations was planned to begin on September 1.

Revised orbital data announced by the National Aeronautics and Space Administration for Explorer 12 include: perigee, 180 miles; apogee, 47,800 miles; inclination, 33.3°; period, 26hr 25min. The estimated lifetime of the satellite is one year.

EXPLORER 13 BRIEFLY IN ORBIT

Explorer 13, a NASA satellite designed to investigate the nature of micrometeoroids and their effects on space flights, was successfully launched by Scout vehicle from Wallops Island on August 25. In addition to placing the satellite in orbit, the second major objective of the launch was to study the performance, structural integrity and environmental conditions of the Scout vehicle and guidance-control system.

The orbit achieved was first reported to have a perigee of 175 miles and an apogee of 606 miles, inclined to the equator at 36.4°. Orbital period was 97.27min. Later, however, NASA reported that the satellite had re-entered the Earth's atmosphere on August 28, indicating that the initial perigee was lower than first reported. The payload weighed 187lb, including 50lb spent fourth stage and 12lb transition section, and comprised a 76in cylinder, 24in in diameter. The surface was virtually covered with five types of detectors exposed to micrometeoroid impact and penetration.



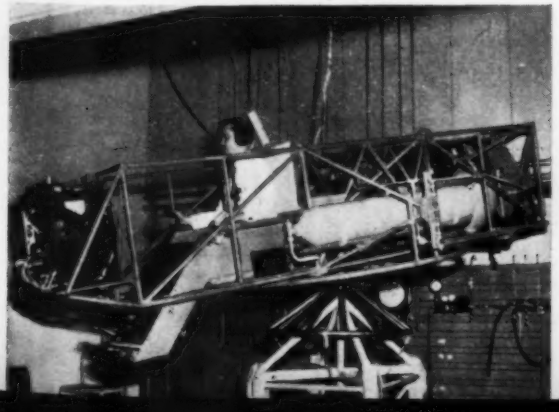
EVEN BIGGER SOLID FIRED

Aerojet-General Corporation achieved a spectacular step forward in the keenly contested battle to win large contracts for giant solid motors when, on August 26, they fired the largest such motor yet built in the West. Propellants have not been divulged, but the configuration of the four sections of which the charge was composed was a typical six-lobe star-centre. The charge weight has been given as 75, 78 and 80 short tons. The motor case was just over 30ft in length and 8ft 4in diameter, and a single fixed nozzle was employed.

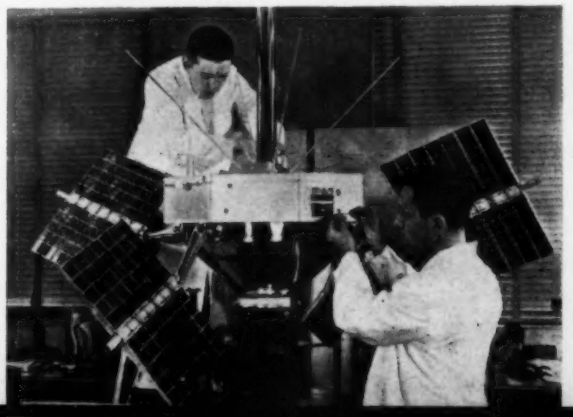
One of the photographs shows the motor being fired, on a

("Missiles and Spaceflight" news is continued on page 406)

This spacecraft control simulator, mounted on an air-bearing, is being tested at the Chance Vought plant at Grand Prairie, Texas



Explorer 12 progress is reported on this page. The picture below shows the 83lb satellite prior to launch at Cape Canaveral



Above, Piper Cherokees on the production line at Vero Beach, Florida. Current production rate of the type, which sells for £5,200 in Britain, exceeds three per day

Left, sporting balloonist Fred Dolder of Switzerland last month commemorated Spelterini's 1910 balloon crossing of the Alps by repeating the flight, ascending from Murren. Here the Eiger mountain forms an impressive backdrop to Dolder's "Bernina"

Sport and Business

MERCURY AIRLINES of Manchester Airport have been appointed North of England dealers for Mooney Mk 21 aircraft, the UK distributors for which are R. K. Dundas Aero Ltd, London. Mercury's Mk 21 demonstrator, G-ARTB, was due to be delivered early this month, after a nonstop flight from Boston to Manchester by ferry pilot Walter Moody of Max Conrad Aviation. One of the directors of Mercury Airlines, Mr Geoffrey Wilkinson, was the pilot of the *Flight*-entered, Dundas-owned Mk 21 which came second in its class and third overall in the Royal Aero Club's recent Business and Touring Aircraft Competition at Kidlington. Other directors of the company are Lord and Lady Calthorpe, Capt I. D. Wallace and Capt P. G. Gurdon. The R. K. Dundas company is now negotiating further regional dealerships for the Mooney Mk 21.

A STRONG FRENCH CONTINGENT is expected to attend the Popular Flying Association's international rally at Fairwood Common Airfield, Swansea, this coming weekend (September 9–10). This year's winner of the Masefield Trophy will probably be decided by a fly-off between the McAully and the Armstrong Whitworth groups at the rally.

HAMPSHIRE COUNTY COUNCIL Planning Committee rejected on August 25 two applications for the development of a private aerodrome on the site of Blackbushe Airport. The applications, made by AVM Donald Bennett, were for the use of an area of 325 acres as a private aerodrome, and for the erection of aircraft hangars. The vice-chairman of the committee, Lord Porchester, said that the Ministry of Aviation was now supporting AVM Bennett in his attempt to re-open Blackbushe for private flying. The reported reasons for the committee's decision were that most of the land was to be an open space, the proposal would be detrimental to the amenities of Yateley village, and it would interfere with safety and traffic flow on the Basingstoke-London trunk road.

THE ROYAL SWEDISH AERO CLUB has selected the Piper Colt as the standard trainer for use by flying clubs in Sweden, following one-week competitive trials in which the MFI Junior, Morane-Saulnier Rallye and Cessna 150 also participated. An initial order for 30 Colts has been placed. The selection was made by a panel of judges including test pilots, Royal Swedish Air Force inspectors, flying instructors and aviation insurance underwriters; and representatives of 38 Swedish clubs were also given the opportunity to fly the aircraft. Auxiliary fuel tanks, increasing the capacity to 36 gal and the cruising range to 648 miles, are specified for the 30 Colts on order. Deliveries are scheduled to begin in mid-September.

BEECHCRAFT QUEEN AIRS numbered 100, 101 and 102 have been purchased for executive and engineering personnel use by Lockheed Missiles and Space Company, Sunnyvale, California. Average stage length will be 100-500 miles, with an average of six passengers plus crew of two.

NEW ZEALAND'S AERIAL-WORK INDUSTRY is considering introducing a special agricultural pilot's licence for such occupations as aerial spraying, crop-dusting and fencing. The licence will replace the commercial pilot's certificate at present required by the Civil Aviation Administration for such pilots and, according to Mr. R. K. Garnham, President of the New Zealand Aviation Industry Association, will enforce higher qualifications for several aspects of agricultural aerial work.

Aimed at increasing safety in agricultural flying—New Zealand still has the lowest topdressing accident rate in the world, despite five fatal crashes in five weeks earlier in the year—the licence will be the first official standard set specifically for agricultural pilots. Topdressing schools operate at Wanganui and in Southland and these schools, or perhaps a special Government Air College (as recommended by the Inspector of Accidents, Wg Cdr O. J. O'Brien), will train pilots for the agricultural licence if it is enforced. A special committee is at present studying the licence proposals before making recommendations to the Government and the industry.

IT IS REPORTED from New Zealand that the Bennett Airtruck (550 h.p. Pratt & Whitney R1340) has flown 130hr and completed its trials. Issue of a Certificate of Airworthiness is subject to Civil Aviation Administration satisfaction with the results of the trials. Designed by Mr Luigi Pellarini, the Airtruck is an all-metal agricultural aircraft of unconventional appearance, incorporating a number of features of the Australian PL-7 designed in 1955 by Mr Pellarini for Kingsford Smith Aviation Service.

FOUR AERO COMMANDER 500B executive aircraft have been sold to the International Co-operation Administration for use by the Presidents of four African republics—the Ivory Coast, Niger, Dahomey and Upper Volta.

Newly appointed northern-England dealer for the Mooney Mk 21 is Mercury Airlines of Manchester. A second demonstrator is due to join the Dundas-owned G-ARNA here illustrated (see news-item on this page)

Champions at the recent USSR sporting parachuting competitions at Vladimir included (from the left) V. Raevsky, G. Mukhina, I. Solovyeva, V. Guryashina, L. Krasilnikov, F. Soldadze and I. Luzanin

FR MK20 Refuelling Pack

* **COLLAPSIBLE DROGUE** *folds when fuel hose is retracted*
* **MORE COMPACT POD** *which houses folded drogue*

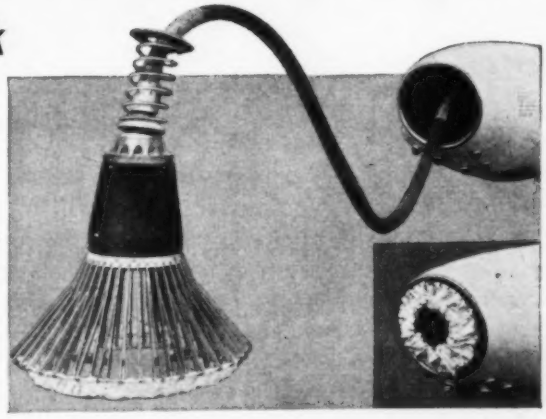
The FR Mk 20 Refuelling Pack—the unit that rapidly converts a fighter into an aerial tanker—now incorporates two major modifications which result in a more compact, more streamlined shape for the pack, with correspondingly less drag.

This unit is capable of refuelling another aircraft at a rate of flow of 150 gallons per minute at a constant 50 p.s.i.

The pack is designed to accept fuel from the carrying aircraft to supplement the supply required by the receiver aircraft. Should refuelling not take place, fuel from this pack can also be used to augment the carrying aircraft's own supply. Jettisoning is provided for emergency conditions.

Illustrations show Scimitar-to-Scimitar refuelling with the Mk 20 Unit (photo by G. Woollard of Vickers-Armstrongs, South Marston) and the pack during ground testing at Tarrant Rushton (note photo showing drogue folded and stowed).

The Mk 20 Unit is scheduled to go into service with SCIMITAR and SEA VIXEN aircraft of the Royal Navy.



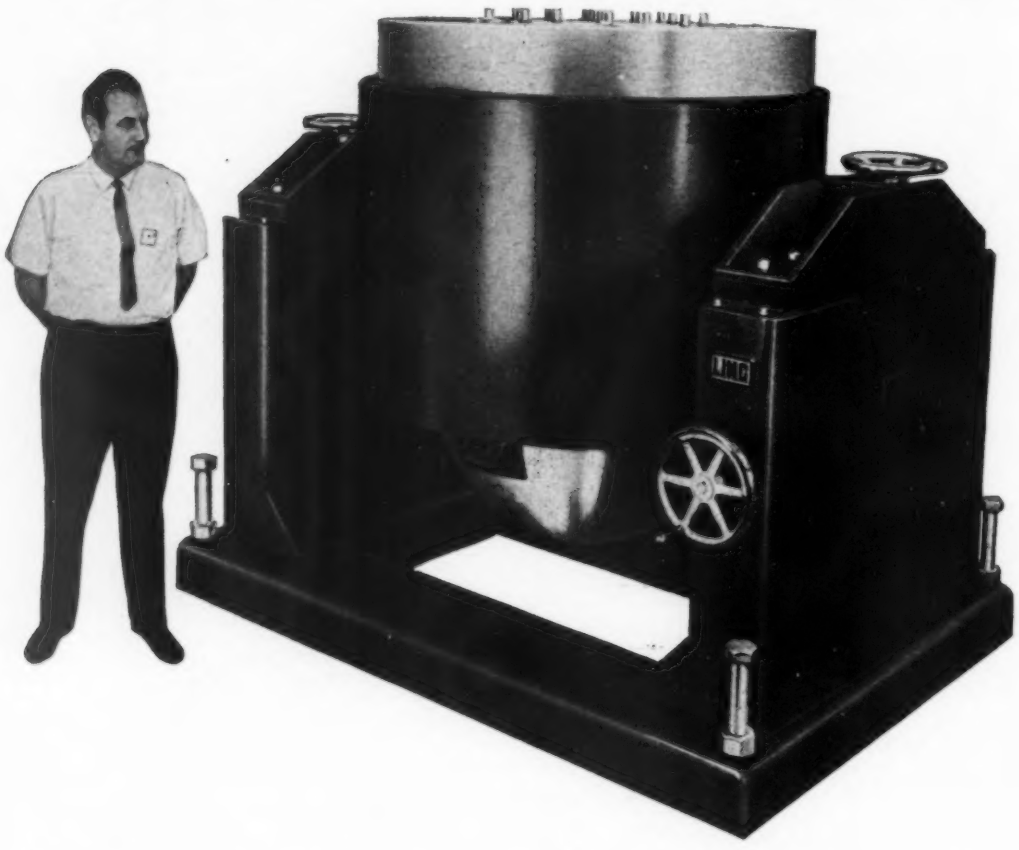
Flight Refuelling Ltd.,
Tarrant Rushton Airfield, Blandford, Dorset.
Telephone: Blandford 501.
Telegrams: Refuelling Blandford.

Visit us at Farnborough on Stand 245 Telephone: Air Show 4020

TA 6086

NOW IT'S PYE LING

A NEW FORCE IN ENVIRONMENTAL ENGINEERING



Pye, one of the foremost names in British electronic engineering, has now consolidated the achievement of its subsidiary, W. Bryan Savage Ltd, and at the same time broadened the scope of its activities by bringing it into association with the great Ling Temco Vought Corporation of America to form a new Company, PYE-LING LIMITED. This organisation will produce a range of Vibration and Fatigue Testing equipment that will be unmatched throughout the world for comprehensiveness and quality. The resources and experience of both the Pye Group and Ling will ensure that the British Aircraft Industry will have immediately available the precise equipment it requires for the proving of every type of component.

The Liquid Cooled Vibrator illustrated has a Thrust Rating of 30,000 lb. and is the largest of a comprehensive range which starts at 25 lb.

PYE LING
VIBRATION ENGINEERS

PYE-LING LIMITED, 7-8 DALSTON GARDENS, STANMORE, MIDDLESEX

AP 22

TWENTY-SECOND SBAC SHOW

First Report from Farnborough

WITH a backing of larger-than-ever export orders (see page 393) and more stands (397) than in any former year, the twenty-second Society of British Aircraft Constructors' Flying Display and Exhibition started last Monday in good commercial fettle. Today (Thursday) was the hundredth flying display staged by the SBAC: in the first, held at Hendon in June 1932, there were 34 aircraft; in this year's, about 150. This total is, however, largely made up of Service aircraft: manufacturers are demonstrating some 23 different types. Only two of these are entirely new, the Beagle B.206 and Handley Page H.P.115, which latter made its first flight at RAE Bedford on August 17. Four types of missile are on show for the first time in Britain: Blue Streak, Red Top, Blue Water and Jaguar. Among the 8,500 visitors from overseas coming to Farnborough this week there were due to be present the Russian designers Ilyushin, Yakovlev and Antonov.

ILLUSTRATED WITH "FLIGHT" PHOTOGRAPHS

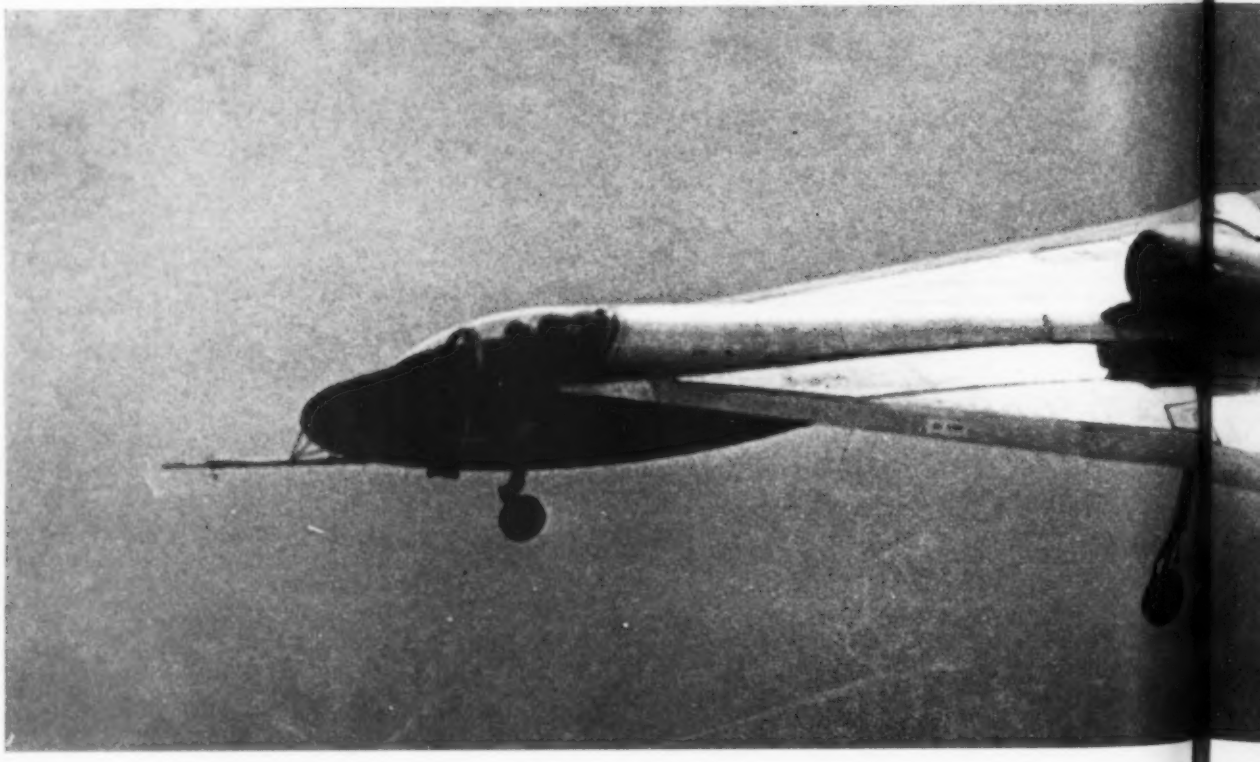
The Lightning F.1As of 74 Squadron

Consortium: Lightning T.4 and Jet Provosts

Gnat trainer

TWENTY-SECOND SBAC SHOW . . .

Beagle B.206



Top, Herald 200

Above, Beagle AOP.11

Left, H.P.115

THE TWENTY-SECOND SBAC SHOW . . .

The Monday Scene

WITH the top of Blue Streak in cloud at nine o'clock, and a Whirlwind apparently taking soundings, there was a misty Monday morning atmosphere at Farnborough on the opening day of the SBAC Show. Furled umbrellas seemed the order of the day in the static aircraft park, where the unbelievably slender Handley Page H.P.115 was one of the main centres of interest. Not far behind in attracting attention was the white-and-bronze Beagle B.206: nor did the rest of the Beagle family lack admirers—the Airedale with its tail well up, the AOP.11 (in Army colours) looking becomingly militant. When it came to colour, the Herald 200 in the white-blue-and-gold of Maritime Central Airways struck a gay note, challenging in attractiveness the yellow-and-red Meteor WH505 developed by Flight Refuelling as a pilotless target, or de Havilland Engines' all-blue Gyron Junior Javelin. The black Napier icing-research Lincoln loomed sombre in the general meteorological gloom, while the Comet 4C of Middle East Airlines brought a pleasing reminder, with its cedar-of-Lebanon insignia on the tail, of oriental sunshine and limitless blue skies.

At the midday weather briefing in the pilots' tent, the met man showed a chart on which the isobars were conspicuously widely placed; he could promise no better than a very slow clearance, visibility improving gradually from its current 4,000yd/two-mile level, cloudbase lifting from 1,800ft to a maximum of 2,500. At Odiham, one of the diversions, weather would be "precisely the same": the basic trouble was a slack wind gradient, generally easterly, of less than 5kt; nor was the sun getting a chance to warm up the lower layers of cloud.

It made a brief appearance just before half-past eleven, catching the lofty silver shape of Blue Streak and shining on the silver spurs of the Royal Artillery officers of 111 (Dragon) Battery, in their Thunderbird and Blue Water demonstration pen next to the static aircraft park. Up on the hill, in the manufacturers' missile park, Blue Streak had a mirror beneath it to show the propulsion bay; by it was the warlike Blue Steel. Nearby, in the open-air equipment exhibition, a Short Belfast fuselage section dominated the scene; there was an extra row of exhibitors' enclosures, on the other side of the road leading to the covered equipment exhibition; and the big aircraft groups, Hawker Siddeley and British Aircraft Corporation, had an impressive ribbon of commissionaires. "Farnborough gets in a groove," said an evening paper bill. But at least one with sociable sides.

Civil Transports

Armstrong Whitworth AW.650 Argosy Because of production commitments no AW.650 appears in this year's SBAC display. The US airline Riddle has now taken delivery of all seven aircraft on order, and are achieving up to 13hr per day per aircraft on USAF "Logair" services. An illuminated map on the Hawker Siddeley stand shows the 12,347 miles of "Logair" routes over which Argosy services are operated at the rate of 4,200hr per year per aircraft. Three Argosy 100s for BEA (the balance of the original Argosy production batch of ten) are to be delivered to the corporation soon after the show, and to enter service from November 1 on BEA's European all-cargo routes. BEA will use the Rolamat system of loading and unloading, a special display of which can be seen in the outdoor equipment park.

Avro 748 Series 1 (G-ARMV) On show is the third 748 (it is actually the seventh aircraft, including structural-test specimens and assemblies accidentally destroyed by fire). In Skyways colours, it will be delivered to the UK independent soon after the show for six weeks of route-proving as the last phase of the airworthiness certification programme.

On display behind the main exhibition hall is a fuselage section in Aerolineas Argentinas colours, furnished to this airline's specification. Of interest is the folding double passenger chair, which will be standard for this operator, and an ingenious hingeing jump-seat. Aerolineas have nine on order, and are to be the first customer to take delivery of the 748—in October. This is by agreement with Skyways and BKS, who respectively have three and five on order. Both Skyways and BKS will receive deliveries in time to start services next spring.

Tropical trials of the 748 were completed shortly before the show, and are reported to have been entirely successful. About three weeks' further flying by the manufacturer are called for for completion of C of A trials in addition to the Skyways route-proving.

The first Indian-assembled 748 is due to fly soon, followed by three others. The Indians have also ordered, for assembly, three Series 2s. The first entirely Indian-built aircraft will fly next year, the first of a very large number—probably more than 100—for the Indian Air Force.

Soon after the show Avro will convert the second prototype Series 1 to Series 2 (Dart 7) standard: by the time the first production Series 2 (one of three for Aden Airways) flies in May, the C of A tests of this version should be almost complete. Aden Airways will take delivery of their first aircraft in June.

748 project work continues; of special interest is the **Avro 778**, a rear-engined twin-jet development for possible availability in four or five years' time. No figures are being issued, and the project depends primarily on a suitable engine. Project work on the **Avro 758**, the aft-loading military version, is in hand, but again no figures are available.

New data are being made available for the two stretched versions, the **748E** and the **748 Super E**, respectively powered by the Dart 7 and the Dart 10. The Super E, announced for the first time at the show, has a maximum weight of 43,000lb and, with a 270kt cruising speed, is the fastest member of the 748 family. Maximum-payload (14,000lb) stage length is 200 n.m. with full SBAC allowances.

Bristol Britannia Though this aircraft is not represented at the show, a progress report from BAC records that eleven Britannia operators are flying 14,000hr a month; total hours are now 530,000, with 145,000 landings.

British Aircraft Corporation BAC One-Eleven A good impression of the interior spaciousness of this jet successor to the Viscount is gained from a full-scale cross-section of the cabin displayed on the BAC stand. It includes one seat row (five-abreast) and three windows. Cabin width of 124in provides better-than-Viscount roominess.

The models on the BAC stand show the standard 57-seat mixed-class layout (28 first-class plus 29 tourist-class), and the all-economy-class (69-seat at 36in pitch) version.

It is revealed that the Rolls-Royce Spey engines will have Plessey constant-speed drives.

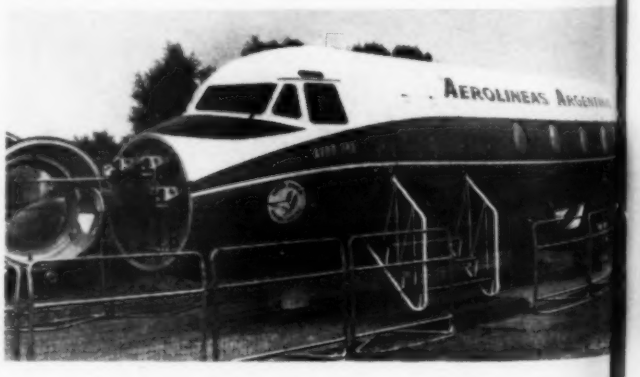
British Aircraft Corporation BAC-107 No public presentation or new information on this twin-jet airliner project is being given at this stage.

de Havilland D.H.125 A big model on the Hawker Siddeley Aviation stand (from which the name Jet Dragon is omitted) shows two typical interiors (a luxurious four-seat layout with tables, and an eight-seater) for this important new executive jet, deliveries of which can be made in 1963. Production work is in hand on a batch of 30 aircraft. Interest by the RAF has been expressed.

de Havilland Comet 4C (G-AROV) On show is the fifth aircraft for MEA, fully furnished, for which the final contract has not yet been signed. This is the 60th Comet 4 variant to be built; all civil orders have now been completed except one Comet 4 for East African Airways (who are now contemplating a repeat-order for 4Cs). RAF Transport Command's five Comet 4Cs are being built at Chester, and a possible RAF repeat-order for seven is believed to be in an advanced stage of negotiation. An order for an executive Comet 4C for a Middle East customer is likely, and the RCAF may also buy 4Cs.

On the Hawker Siddeley Group stand indoors appear displays illustrating the significance of the Comet 4C's recently announced 20kt increase in cruising speed, and there is also an illustration of typical work done by Comets in world-wide airline operation.

Avro 748 fuselage section



Full-scale cabin cross-section of BAC One-Eleven

—and of the civil Short Belfast

de Havilland Heron For the first time since the first Heron flew in 1950 no Heron is on display. The aircraft is still in production, mainly for the executive market, a total of about 150 having been built.

de Havilland D.H.121 Trident News of progress with the first Trident, which was rolled off the Hatfield assembly line on August 4, is that engine runs have been completed (with two engines, one centre and one side, installed) and have proved "entirely satisfactory." A short series of taxying, braking and steering trials have also been carried out at Hatfield, and these also are reported to have been completely successful. The aircraft is now in the hangar undergoing final fitting out (including completion of the flight recorder installation) before first flight. This will be "during the coming winter," although if all goes well it is possible that the first Trident will be airborne before the end of 1961. The second production aircraft is due to be rolled out in the near future. Seven aircraft will be taking part in the flight-test programme during 1962. Deliveries to BEA are scheduled for the end of 1963, and Tridents will be introduced into service by the corporation in April 1964. No new information on the proposed Trident 2, the developed version with improved payload/range performance, on which BEA have an option (12), is available.

Handley Page Herald Series 200 (G-ARTC) The first Series 200 Herald to be publicly displayed, this lengthened version of Handley Page's feeder liner appears in the attractive blue, yellow, silver-and-white markings of Maritime Central Airways who, together with their associate Nordair, have ordered three. The two companies have an option on six more Herald 200s. This particular aircraft is not actually intended for MCA, being at present used by Handley Page for completion—now imminent—of the certification programme. The radome on this aircraft is a mock-up installation for aerodynamic testing.

Jersey Airlines are the first customers due to take delivery of the Series 200, of which six are on order; the first two will be handed over soon after the show to replace their two leased 100s which, in the hands of this operator, inaugurated the first Herald services.

The first two of the three 100s bought by the Ministry of Aviation for BEA are due to be handed over towards the end of this year, with the third early next year. Operations on the corporation's Highlands routes will start in the spring.

Important news announced at the show is that, in addition to a production batch of 25 Heralds, a further batch of 25 is now being laid down. As already reported, the all-up weight, and hence payload-range performance, of the Herald 200 has been raised from 40,000lb to 43,000lb. It is possible that a new Herald order will be announced at the show.

Handley Page HPR 8 A model of this car ferry development of the Herald—with which the name Silver City is still being linked by Handley-Page—is on show on the stand.

Short SC.5/31 Belfast Being emphasized this year is the unique two-deck fuselage layout of this civil swing-nose development of the RAF's military freighter. Shown in the outdoor exhibition is a full-scale fuselage cross-section with passenger seats on pallets rolled in as the upper deck, and loaded freight pallets on the lower deck. Shorts claim that 141 passengers (on the top deck) and 60,000 pounds of freight at 10lb/cu ft, mainly on the lower deck, can be carried by the Belfast.

Short Skyvan Progress with the prototype piston-engined Skyvan, which was to have flown this summer, has been delayed because of concentration of work on the Belfast. However, the first aircraft is due to fly at the beginning of 1962. A note on the new turboprop Skyvan 2 appears on page 371.

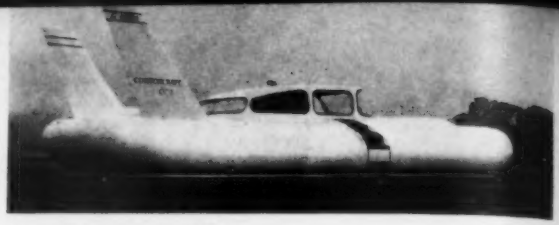
Vickers Vanguard Although a Vanguard is not at the display, a BAC progress report records that the 27 Vanguards in service with TCA and BEA have now flown 16,200hr.

Vickers VC10 and Super VC10 Models on the British Aircraft Corporation's stand enable a comparison to be made between the standard and lengthened variants of BAC's big jet.

Of particular interest is an unusual display, on the company's stand, illustrating the engineering techniques used in the VC10 structure; for example, fabrication of the milled wing panels can be followed from a billet to completed component. Also shown is the first VC10 engine-support beam, machined from high tensile steel. The wing of the first VC10 is due to be joined to the fuselage this month.

de Havilland Comet 4C

C



Above, Britten-Norman CC-1
Left, part of Westland Rotodyne model

Private and Executive

Beagle Airedale (G-ARKE and G-ARNP) Two Airedales are on show, the prototype KE now re-engined with a 175 h.p. Continental performing in the flying display, and the 180 h.p. Lycoming-powered NP (the third production machine) in the static park. The fuselage of G-ARNS, another production aircraft, is to be seen on the company's stand.

Beagle Terrier (G-ARRN) This three-seat conversion of the Auster AOP.6, Gipsy-Major-powered, appears in white and fluorescent red—the only Beagle to forgo the company's white/copper bronze/grey or white/copper bronze/white paint scheme.

Beagle B.206 (G-ARRM) One of the most exciting and most significant new aeroplanes to appear at Farnborough for many a year, the first big Beagle is as attractive in the flesh as it appeared in advance from photographs and drawings. In addition to the prototype aircraft which appears in the flying display, a cabin-section mock-up is presented on the company stand in the exhibition hall.

The prototype B.206 (two 260 h.p. Continentals, of the type to be built by Rolls-Royce) had logged some 16 hours' flying at the beginning of the display week. After the SBAC Show it is to be fully instrumented and will begin its certification and development flying programme in earnest. The company plans a production run of 250 aircraft.

Beagle M.117 The models on the Beagle stand include one representing the low-wing, single-engined M.117. Two versions of this aircraft are planned, powered respectively by a Rolls-Royce Continental engine of 100 and 145 h.p. The lower-powered type will have fixed undercarriage and will cost "slightly over £3,000"; the higher-powered version will be available at £4,000-£4,500 with either fixed or retractable gear, and its engine will drive a constant-speed propeller.

Beagle M.218 A cabin mock-up in the exhibition hall gives a preview of the trim interior of the second Beagle twin, which will bear the same relationship to the M.117 as the Gemini does to the Messenger. A single, centrally mounted blind-flying panel is a feature of the instrument layout. Two versions of the aircraft will be offered, powered respectively by the 100 h.p. and 145 h.p. Rolls-Royce Continental. Price of the lower-powered version will be between £5,000 and £5,500. The higher-powered machine will have clipped wings and a slightly higher gross weight.

Beagle WA.116 A covered-fuselage version of the McCulloch-powered ultra-light autogyro is now under construction. No example is on display at Farnborough.

de Havilland Dove 8 (G-ARDH) A standard production Dove 8 (two Gipsy Queen 70 Mk 3 engines), finished in white with red trim and used as a demonstrator, appears at Farnborough.

de Havilland D.H. 125 Two handsome models (one part-cutaway) of the Viper-powered executive jet aircraft are included on the Hawker Siddeley Aviation stand.

Helicopters

Westland B.194 Project A model on the Hawker Siddeley stand shows this 30–50 seat, tandem-rotor transport helicopter project which would use four D.H. Gnome engines.

Westland Belvedere (XG459) A standard Belvedere from the RAF production line, fitted with 19 troop seats, appears at Farnborough.

Westland Rotodyne (XE521) The Eland-powered prototype was due to fly over from White Waltham daily to take part in the flying display. A large model of the Tyne-powered production Rotodyne on the Westland stand shows the revised wing planform, and also an additional (rear) jetpipe on each engine nacelle. The extra jetpipe is a clear indication of an additional gas turbine located in the nacelle. The use of lightweight bleed engines would provide air

TWENTY-FIRST SBAC SHOW . . .

to the tip pressure-jets and allow the Tynes to be used as simple turboprops.

Westland-Wasp/Scout ("G-WASR" and XP165) A complete Nimbus-powered Wasp (five-seat passenger version) is displayed in company colours on the Westland stand, and a production Scout appears in the flying programme.

Westland Wessex (XM300) The example of the Gazelle-powered Wessex at Farnborough is a standard Mk 1 machine in Royal Navy colours, equipped with dipping-sonar equipment, Doppler aerials and minesweeping gear. On each side of the fuselage are stubs to which homing torpedoes or extra fuel tanks can be fitted.

Westland Whirlwind (G-APDY) The civil Series 3 Gnome Whirlwind demonstrator shown at the SBAC Show is fitted with eight seats and finished in company colours.

Ground-effect Vehicles

Britten-Norman CC-2 First flight of the company's second Cushioncraft on August 31 at Bembridge was announced by Britten-Norman on Monday of Farnborough week, by which time 1½ hours' flying had been logged. The CC-2 is a ten-seat machine powered by a Rolls-Royce V-8 engine and developed from the three-seat CC-1. Its gross weight is 5,500lb (normal) or 7,000lb (overload); hover-height varies from 24in empty to 12in at normal gross weight; and the 120gal fuel capacity gives a maximum range of 500 miles at normal gross weight. Maximum speed at this weight is 55 m.p.h. Selling price of the CC-2 is quoted as "well under £20,000."

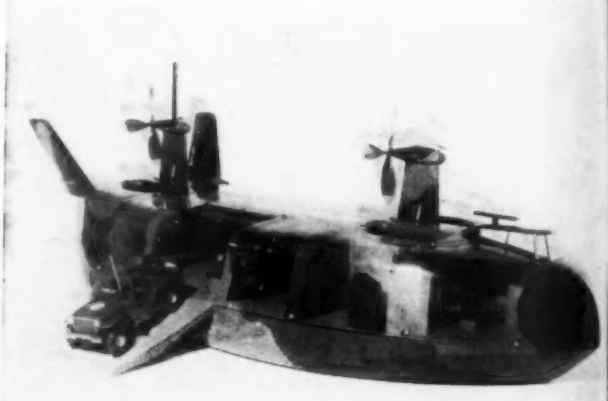
A second CC-2 is being built at Bembridge, but series production will be undertaken elsewhere.

Westland SR-N1 An SR-N1 model is displayed on Westland's hovercraft stand in the exhibition tent. The airframe of the actual machine is now being modified prior to a further series of trials.

Westland SR-N2 A large model of this hovercraft takes pride of place on the Westland hovercraft stand. The machine itself is now externally almost complete and is expected to begin engine running by the end of the year, with flight trials beginning next spring.

Westland SR-N3 Third model on Westland's hovercraft stand depicts the projected SR-N3, a twin-finned, military development of the SR-N2. Carrying a payload of 15 tons or 150 fully equipped troops, the machine would have a gross weight of 40 tons and would be capable of speeds up to 80 kt. Length is 70ft 6in, beam is 29ft 6in, and powerplants comprise four Blackburn Nimbus turbine engines.

Westland SR-N3 model



Military and Research

Armstrong Whitworth AW.660 Argosy C.1 Of 56 Argosies ordered by RAF Transport Command, half a dozen have now been delivered to Boscombe, where familiarization trials are in progress prior to the formation of a squadron.

Avro Vulcan B.2 The latest version powered by 20,000lb-thrust Olympus 301 engines is represented in the flying display by the Bristol Siddeley test bed with two 301s and two Olympus 201s.

Beagle Auster Mark Eleven (XP254) An AOP.9 fitted with a Rolls-Royce Continental 260 h.p. IO470 engine on the production line, this machine carries four 25lb bombs beneath the cabin and Motorola VHF, ILS and ADF radio in addition to military accoutrements. It is soon to be evaluated by the Army. Other features are a French Gyro DI, a DR compass, faired undercarriage legs and plastics-spatted wheels. Slats and a lengthened undercarriage may be fitted later.

Bristol T.188 The aircraft will definitely not appear at the show, but samples of structure, incuding a complex intake unit puddle-welded in stainless steel, are shown on the BAC stand.

Bristol Siddeley strike aircraft A proposal for the application of lift-and-thrust engines to a supersonic strike aircraft shows a delta-winged machine—with a large crew compartment—having lateral intakes with shock cones for engines mounted in the flanks.

English Electric Lightning T.4 (XM974) A production T.4 is in the static park, surrounded by Firestreak missiles, Airpass radar pack, Microcell rocket pack and Aden guns with ammunition.

Flight Refuelling Meteor U.16 (WH505) A red-and-orange drone version of the Meteor F.8 produced by Flight Refuelling is in the static park.

Folland Gnat Trainer (XM693 and XM698) The third prototype, XM693, painted glossy white, is flying in the display. It has almost completed the erect spinning programme and carries test instruments and an extra-long pitot boom. XM698 is the second production aircraft in the first batch of 14 and bears CFS markings. It has OR946 roller blind instruments, 64gal of fuel in the wing "shoulders," 62gal slipper tanks, the "splat" flaps and the final tailplane control. The last-named now has constant springs for feel and trimming with tailplane response adjusted by cam and a q unit to airspeed. As the gear goes more than half down, the tailplane datum shifts 3° to compensate for trim change. XM698 is surrounded by rockets, bombs, and gun- and camera-packs. A procedure trainer for the RAF, complete with simulated engine starting and ejection, is in the equipment park, and the latest Folland Mk 4 seat is on the stand.

Gloster Gyron Junior Javelin (XA552) An early production Javelin FAW.1, painted dark blue, this machine was converted by Napier and has been flown by de Havilland Engines. Some 21hr of development flying with two low-powered, afterburning versions of the Bristol T.188 engines have been completed, the objective being to prove the low-speed handling of the engines in preparation for the early flights of the supersonic research aircraft. Eight additional fuel-boost pumps are housed in six under-wing fairings.

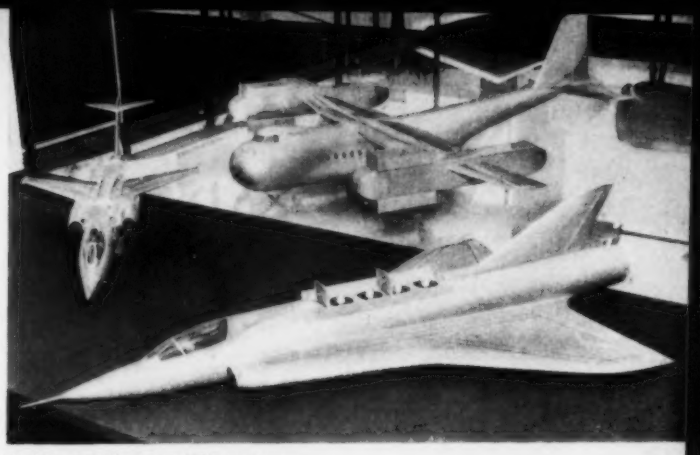
Handley Page HP.115 (XP841) Some 7½ hours' flying with this narrow-delta research aircraft had been completed by Monday. Take-off is protracted, but landing speed and attitude moderate. Leading edges and elevons are fabric-covered, with spring- and trim-tabs on elevons. The airbrakes are set proud of the wing. The unpressurized cockpit has a Martin-Baker VTO seat.

Handley Page Military Herald Completely new at the show is a rear-loading version of the Herald, a model of which appears on the Handley Page stand. Named for the present the Military Herald, its production will utilize about 80 per cent of standard Herald tooling. The most obvious modification is the rear end, incorporating flap doors for rear loading. Power is increased by installation of Dart RDa.10s, and all-up weight is 46,000lb. The version has been built with civil as well as military needs in mind.

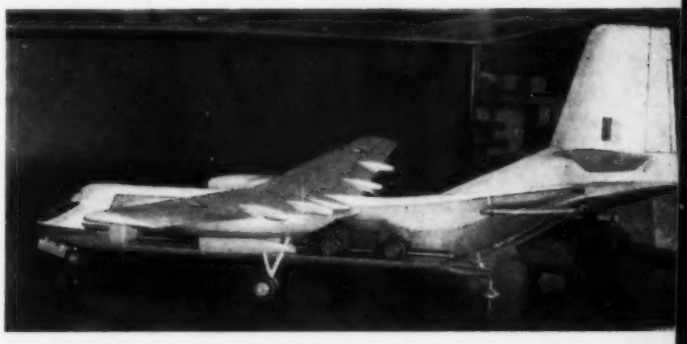
Handley Page Victor B.2 (XL164) This is a standard RAF Victor B.2. Pictures have been released of this type carrying a Blue Steel

Hawker Hunter 66A (G-APUX) Still a good sales prospect, this Hunter has recently flown a series of low-level missions at M0.88 at maximum continuous power, with 230gal underwing tanks, to show its ability to act as a navigation trainer for the F-104G or later aircraft. The full F-104G cockpit and attack system could be accommodated. G-APUX will shortly be used for RAE trials of Rank Cintel Peep head-up instrumentation.

Hunting Jet Provost T.4 (XP547) Shown this year in the flying display is a production T.4, powered by a Viper 11 giving 2,500lb thrust, as shortly to be delivered to the RAF. Increased thrust provides much higher performance and reduces time to 30,000ft to 12½ min. The RAF will keep pupils for 40hr more on these aircraft, leaving 70hr instead of 110hr for the advanced trainer. The export



Models of Rolls-Royce VTO projects



Handley Page military Herald model

version of the T.3, the T. Mk 51 (G-23-1), is displayed carrying four 3in rockets, eight practice bombs and two guns.

Napier Icing Research Lincoln (G-29-1) This venerable workhorse carries a Buccaneer tailplane section and will later test, in turn, a "supersonic fighter intake," a cargo-aircraft wing section, a submarine-search aerial system and a laminar-flow wing section. Under No 4 nacelle is a section of Napier all-bonded helicopter blade undergoing endurance testing.

Rolls-Royce VTO projects Models on the Rolls-Royce stand show applications of lift engines to military projects. This technique is discussed on p. 396 of this issue.

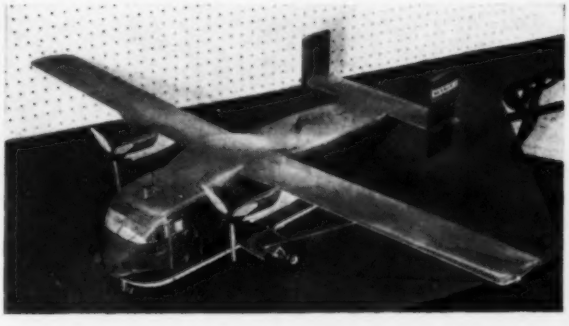
Scottish Aviation Twin Pioneer (XP294) This RAF CC. 2 machine is a reminder that civil and military Series 2 and 3 Twin Pioneers are operating successfully in many parts of the world.

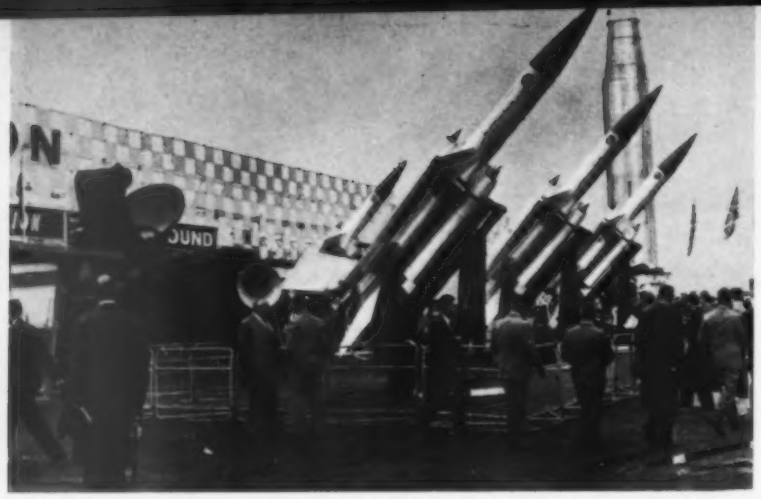
Short SC.1 The first SC.1 has been brought from Bedford to the flying display. The second aircraft is now at Belfast being fitted with the Mk 3 autostabilizer and equipment to allow automatic transition and landing. A 15° glide-slope beam and range measurement will be used, together with the lift compensator using gyro-sensed acceleration signals for height control in transition.

Short Skyvan 2 Shown in model form, this military development of the civil type has Astazou 530 h.p. turboprops and rough-field undercarriage. Gross weight is 11,500lb, maximum payload 4,500lb and maximum range 700 n.m. Typicals loads are 14 troops or 12 stretchers. The rear ramp allows paradropping. Take-off distance to 50ft from wet grass at 11,500lb is 1,365ft.

Short SC.5 Belfast Models in various parts of the static exhibition show the ability of the Belfast to accommodate most of the vehicles and missile systems in the British arsenal.

Short Skyvan 2 model





Britain's most successful export guided weapon: the Bristol/Ferranti Bloodhound, with Blue Streak beyond. These are actually Bloodhound 1s; the export winner is the advanced Mk 2

TWENTY-SECOND SBAC SHOW . . .

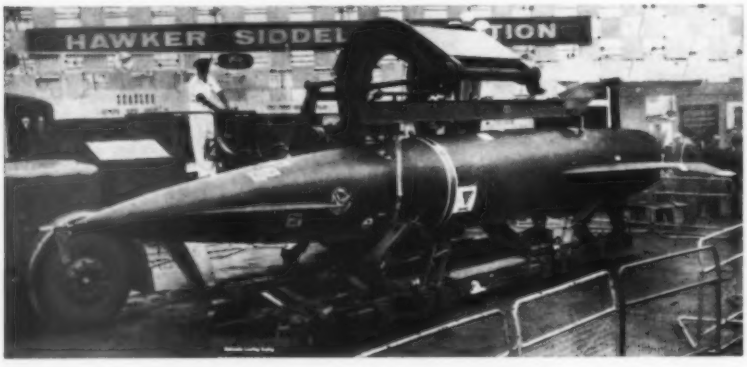
Static-show highlights

Armstrong Whitworth Seaslug A product of the recently formed Whitworth Gloster Aircraft Ltd, the Royal Navy's ship-to-air guided weapon has shown itself to have exceptional reliability and accuracy. On September 4 the Admiralty and MoA allowed the manufacturers to announce that "in final test firings, from HMS *Girdle Ness* in the Mediterranean, a success ratio in the order of 80 per cent has been obtained against fast, high-flying and low-level target drones." During these trials Canberras were intercepted at heights well over 50,000ft, and in seven recent firings four targets were actually struck by the inert missile. When *Girdle Ness* returns to the UK at the end of this year the research and development programme for Seaslug 1 will be virtually completed. A yellow-painted Seaslug 1 is on view, with a recent type of control ring responding to a series of test signals. Of Seaslug 2, the prime contractors —Whitworth Gloster, GEC and Sperry— can say only: "Longer range; better performance against extremely low-flying targets; surface-to-surface capability; requires no modification to existing shipboard environment."

Avro Blue Steel In the outdoor guided-weapons park is an impressive exhibit, staged by A. V. Roe Weapons Research Division, ML Aviation and AEC Ltd, and manned by a crew from No 4 Joint Services Trials Unit based at Woodford (Avro's weapon centre). Blue Steel is transported on a vehicle based on the AEC Matador chassis; and, since the span of the missile exceeds 9ft 6in, it requires a police escort. On arrival at the airfield dispersal the transporter parks close to the bomber to be loaded and its four steady-feet are lowered hydraulically. This provides a rigid base, which does not tilt when the big weapon is hoisted out sideways like a lifeboat from a ship. The front and rear trestles are hydraulically lowered, and the missile is traversed outwards by a pair of davits driven through a power take-off from the transporter engine. The hydraulic loading trolley, by ML Aviation, is stationed alongside ready to receive the missile, its final positioning being accomplished by hydraulic motors, energized by fore and aft hand-pumps, driving each wheel.

When the Blue Steel is hanging directly over the trolley the fore and aft trolley cradles are hydraulically raised to take its weight. The transporter suspension, consisting of a rear shackle and a front steel-strip loop surrounding the missile body, is then disengaged and the transporter driven away. The loading trolley may be positioned beneath the bomber by its own hydraulic power, or, if it has to travel some distance, towed behind a tractor. The trolley cradles are elevated through the manual hydraulic system until the missile is accurately positioned beneath the four crutch pads of the Victor or Vulcan, whereupon the single release slip holding the missile to the aircraft may be secured. This ground equipment serves both types of bomber. The low-slung Victor requires that the trolley should be capable of being lowered 6in, by means of pivoting links in its chassis, until the latter is only 2in from the ground; but experience has shown that the Victor is by no means a difficult aircraft to load.

Avro Blue Steel stand-off bomb with transporter and loading trolley



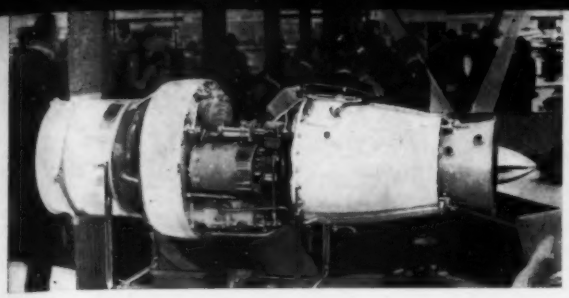
Blackburn Astazou Designed and developed by the Société Turboméca, this compact and refined single-shaft turboprop in the 550–600 s.h.p. class is to be sold in the United Kingdom by Blackburn Engines Ltd, who for many years have been the French company's licensee. There is no other engine in the same class currently available, and if a sufficient market materializes Blackburn will manufacture complete Astazous in Britain. That a British-built Astazou is far from unlikely is suggested by the fact that three British aircraft companies—one of them obviously Short & Harland—are showing strong interest in the turboprop version, while the turboshaft is attracting the attention of two different British companies for what they term "special projects." Some of these applications are military. There is no British propeller specially matched to the engine, but the turboprop exhibit has propeller blades by Dowty-Rotol.

Bristol Siddeley rocket engines According to the makers, "Stentor is the most advanced rocket engine yet designed in the United Kingdom. Using HTP and kerosine as its propellants, Stentor represents a new concept in pump-fed rocket engines, for it is designed to remain stored on periodic stand-by for up to two years without ground running. It thereby overcomes one of the main drawbacks of this type of engine, which usually needs to be carefully prepared and loaded with its propellants immediately prior to launching. Stentor, designed specifically for the Avro Blue Steel stand-off bomb soon to enter service with RAF Bomber Command, has already given a most satisfactory account of itself during proving trials carried out in Australia."

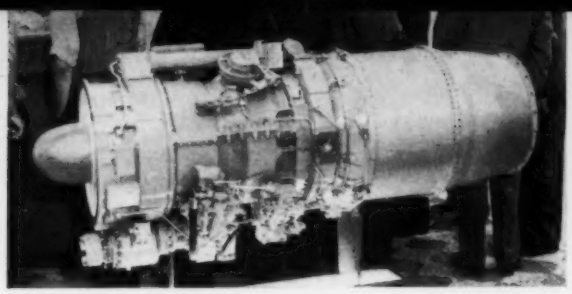
As is well known, this engine has one large thrust chamber and one small one, and the latter is evidently the chamber employed in the four-chamber Gamma Mk 301, which is displayed for the first time. Compared with Gamma 201—powerplant of Black Knight—the Mk 301 is a refined and probably lighter engine. Also on view is the entirely new PR.37, which is a tiny motor with a single chamber fed from pressurized tanks of HTP and kerosine.

Bristol Siddeley Viper On view for the first time, the Viper 520 (previously BSV.20) is rated at 3,000lb thrust, with specific consumption of 0.985. As the photograph shows the powerplant is neatly dressed, and fully equipped to suit the requirements of the D.H.125 installation. The photograph clearly shows the extension due to the zero-stage, the circular compressor blow-off valve and the intake hot-air anti-icing pipe. Bristol Siddeley expect the overhaul life to be 1,200hr within three years of the start of service.

DH pre-packaged rocket As reported last week, the de Havilland Engine Co have a technical agreement with the US Thiokol Chemical Corp which may lead to licence production throughout the UK and Commonwealth of the US company's pre-packaged liquid-propellant rocket motors. These units, currently produced to propel the American Bullpup and Sparrow missiles, combine most of the advantages of both liquid and solid motors and can result in a simple and compact motor with very high performance, insensibility to environment, almost perfect reliability and instant readiness. One such motor, of a size and configuration for a missile a little larger than Red Top, has been planned by de Havilland under the name of Spartan 1. The propellants chosen are nitric acid and a mixture of amines, which are expelled by a pressurizing cartridge and ignite hypergolically.



Blackburn-Turbomeca Astazou (turboshaft version)



Bristol Siddeley Viper 520

English Electric Blue Water Although no further details of this 25ft corps-support missile for the Royal Artillery may be divulged, it is much in evidence at Farnborough. A detachment from the School of Artillery is giving encouragingly brief demonstrations of the missile's deployment at a firing site, and a full-scale white-painted specimen squats menacingly on the British Aircraft Corporation stand. This is the first time Blue Water has been publicly shown in Britain.

English Electric Thunderbird A team from 37 (GW) AA Regiment, Royal Artillery, show precisely how the British Army's surface-to-air missile is assembled and handled in the field. The battery consists of two troops each comprising two identical firing sections with two launchers apiece. They are demonstrating loading of the launcher either by the special launcher-loader or by the Jumbo crane.

GAF Malkara Adopted by the British Army as the standard heavy anti-tank missile of the Royal Armoured Corps, the Australian Government Aircraft Factories Malkara is being introduced to service under the co-ordinating authority of Fairey Engineering, who also hold the sales agency for all countries except the USA. On view at Farnborough for the first time is the vehicle in which it is deployed, made by Wharton Engineering to FVRDE design. Capable of being air-dropped from an Argosy C.1, this lightly-armoured four-wheeler is manned by a driver, missile-controller and wireless operator, and has a launcher arm with hydraulic traverse and missile elevation to the firing position and angle. The arm carries two rounds, which are fired and controlled from inside the vehicle. Two additional Malkaras, with wings and fins removed, are stowed inside the vehicle, and can be manually withdrawn and readied for firing on the launcher within two minutes.

Jaguar Displayed by the MoA in the outdoor guided-weapons park, this "relatively cheap" 7,000 m.p.h. test vehicle has been designed and developed jointly by the RAE Aerodynamics Department and the Australian WRE Aerodynamics Division. The first, second and third stages are respectively powered by Rook, Gosling and Lobster solid-propellant motors, all developed by the RPE at Westcott. Jaguars are fired at Woomera at an elevation of about 70°; and, in the final acceleration up to around 10,000ft/sec, measurements of temperature, pressure and acceleration are telemetered to ground. Picture overleaf.

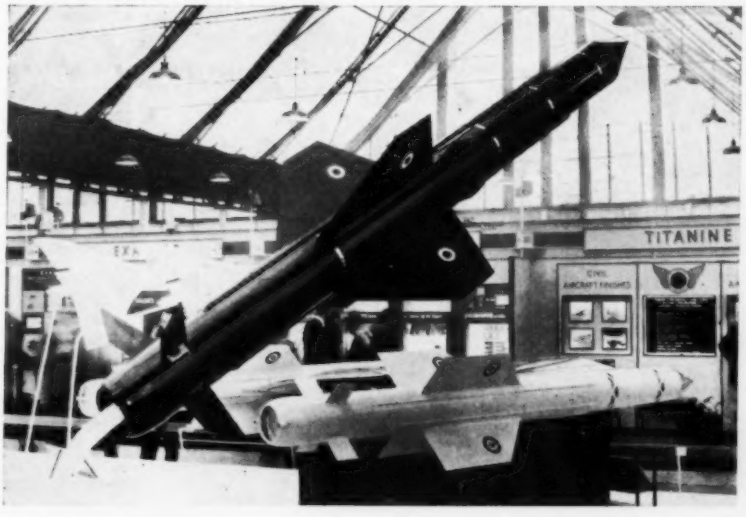
Rolls-Royce VTOL propulsion It can now be stated that jet-lift and propulsion engines "have been specified for new military VTOL and STOL aircraft." This means that these Rolls-Royce engines are under development for prototypes actually being constructed. No nations may be named in this context, but the company have licence agreements with many overseas governments and aircraft firms; in Western Germany, for example, with MAN, Sudring (VTOL strike project), and Weserflug (Transall transport and possibly strike projects).

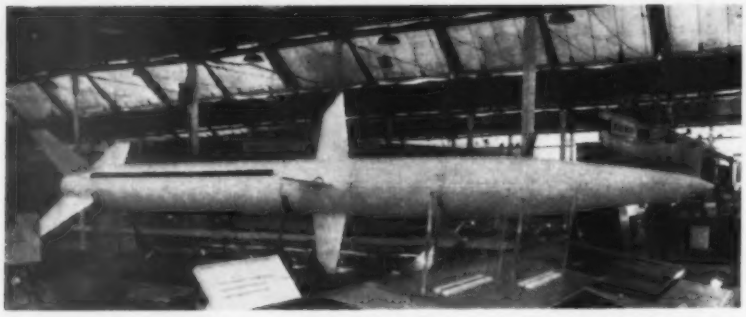
The lecture summarized on pages 396-397 describes suggested VTOL aircraft depicted in a photograph on page 371, with turbojet or turbofan lift engines mounted beneath retractable doors and intake cascades. An indication of how such intakes might be arranged is afforded by a pair of RB.108 engines arranged to pivot in a specimen section of fuselage of approximately SC.1 size. An alternative arrangement is to employ thrust deflection and thus use an engine for both lift and propulsion; small-scale rig testing has led through a number of development stages to a suggested configuration resembling a Rolls-Royce thrust reverser with a rotating outlet cascade. An engine which might well appear with such a deflector is the RB.145, rated at 2,750lb and having a thrust/weight ratio better than 9 : 1. Run for the first time this year, it is displayed with a short afterburner fed by 12 injectors and having six nozzle segments positioned by pneumatic rams. The RB.145 may be mounted in a swivelling installation.

Malkara anti-tank missiles on air-droppable vehicle

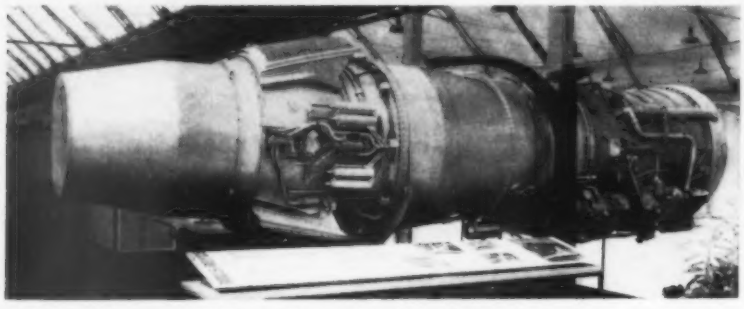
Rolls-Royce Conway 42 An engineering mock-up reveals the precise configuration chosen for the powerplant of the Vickers VC10. The most powerful engine known to be under development for airline use anywhere in the world, the RCo.42 introduces an entirely new low-pressure rotating assembly and by-pass duct handling a very much greater mass-flow. The by-pass ratio is thereby doubled, to 0.6, and the guaranteed minimum thrust of the initial RCo.42/1 for the VC10 is no less than 20,370lb—this rating was revealed only this week, the design figure having previously been 20,250lb. The RCo.42/3, for the Super VC10, has likewise been uprated at a guaranteed minimum figure of 21,825lb.

de Havilland Red Top air-to-air missile, with Lightning Firestreak pack in background





English Electric Aviation Blue Water tactical bombardment missile in exhibition finish

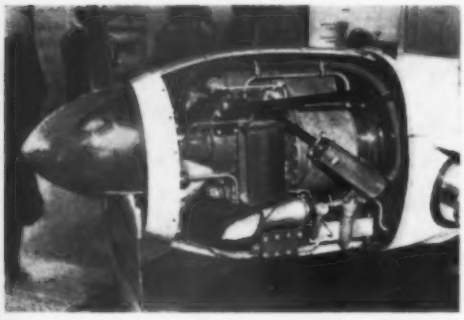


Rolls-Royce Conway RCo.42/1 powerplant engineering mock-up

TWENTY-SECOND SBAC SHOW . . .

As the photograph shows, the RCo.42/1 is dressed externally in an extremely neat manner, and it is unusual in that most of the major units carried on the engine are supplied to Vickers to the latter company's own installational requirements. These units include an English Electric Sundstrand drive (with self-contained oil system) and alternator, and a Godfrey/SRM gearbox compressor (described in *Flight* last week) to provide cabin air. In an engine of this type, with a very high pressure-ratio, it is difficult to find a suitable point from which to bleed air for cabin pressurization at a sufficiently low temperature; and, in any case, the mechanically driven compressor imposes a smaller penalty in terms of fuel consumption. The RCo.42 reverser is a refinement of the unit employed in the present Conway, and it is actuated by eight pneumatic rams. No suppressor is specified for the present VC10, for Vickers and BOAC consider that noise problems with this aircraft should be obviated by its excellent field performance and climb gradient.

Rover TP/90 turboprop



Rover TP/90 At the 1960 SBAC Show Rover Gas Turbines introduced the small turboprop which they have been developing from the well-known 60 and 90 h.p. single-shaft engine used in airborne auxiliary powerplants and many marine and industrial applications. During the past year the company have financed considerable further development, and the present TP/90 is a refined and attractive unit. Weighing 200lb complete with all accessories but without the Dowty-Rotol McCauley propeller, it delivers 120 b.h.p. for take-off and has a specific consumption of 1.36 at the continuous rating of 100 b.h.p. This increased power is achieved by employing the larger compressor used in the Vulcan airborne auxiliary powerplant and by machining the larger turbine from a forged disc of Nimonic 105. Moreover, the propeller reduction gear now has but a single stage, and the output shaft carries bevel drives to a hydraulic pump and generator. Enquiries have been received from aircraft manufacturers in the US, Canada, Australia and Italy, and the actual engine displayed (in a wing installation) is expected to have passed a complete ARB type-test well before the end of the year.

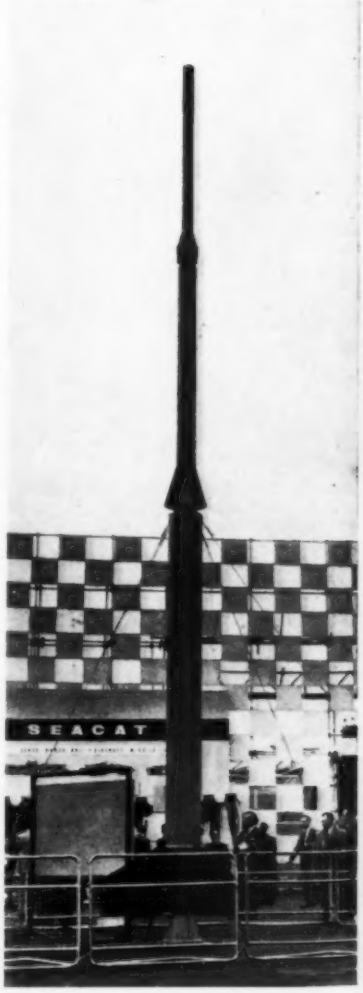
Rover are announcing the Double/90, in which two TP/90 power sections are coupled through a free-wheel reduction gearbox to a single propeller. The Double/90 weighs 359lb and is rated at 240 b.h.p. for take-off.

Rocket Propulsion Establishment In the outdoor equipment park the Ministry of Aviation are exhibiting examples of current research programmes by the RPE at Westcott. Easily the largest piece of hardware is an experimental solid-propellant motor, manufactured by Bristol Aerojet, which must be one of the largest yet produced in this country—although still puny in comparison with the Aerojet-General motor described on pages 363 and 406. Having a diameter of 3ft, it produces a thrust of 40,000lb at sea level and has a burning time of 50sec. Motors of this size are at present being used by Westcott "for the study of problems associated with the development of large motors for ballistic-missile or space applications." Bristol Aerojet have evolved a method of fabricating the case by the spiral welding of high-tensile steel strip, a method which eliminates both the need for large sheets of steel rolled to close tolerances and longitudinal welds. The exhibit has a single fixed nozzle.

A colour film underlines the establishment's considerable breadth of research activity, particularly (nowadays) into solid-propellant motors, and concentrates upon such fundamental problems as the evolution of the optimum charge cross-section and the perfection of swivelling nozzles or other schemes for providing thrust-vector control. Remarkably clear slow-motion sequences explain the combustion of star-centred charges, which can be so arranged as to maintain an approximately constant combustion periphery and hence substantially unchanged thrust right up to burnout.

In the same part of the Ministry's enclosure may be found a free-flight research model which, although not from Westcott—it was first seen at the RAE Open Day in June—is propelled by twin solid-fuel motors. The model under test rides on these motors, and telemeters data during coasting flight from a burnout and separation speed of some 1,150 m.p.h.

Jaguar hypersonic research vehicle



Army manœuvres: four of the eight Skeeters

Monday's Flying

FASHIONABLE comments early on Monday were that the flying display would be "saved by the Services" or "saved by the Beagles." Some people predicted that the saviour would be the H.P.115. As things turned out, a miserable day was saved, as often before, by dogged flying (and radar guidance) and by some uncommonly good helicopter items.

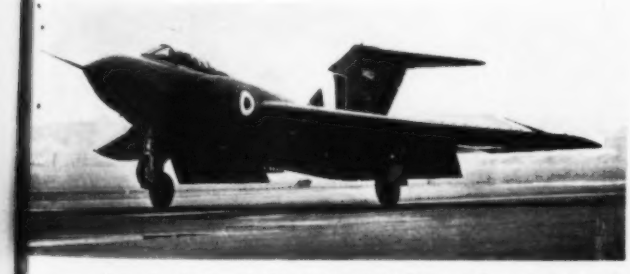
We should not be justified in according a meteorologically mutilated performance the dignity of our usual full-length report. Individual types which got airborne were the Comet 4C, Gyron Junior Javelin, Argosy C.1, Olympus test-bed Vulcan, Beagle B.206, Airedale, AOP.11 and Terrier, and Short SC.1. Especially we recall the spectral disappearance into the gloom—with cloud level at 600ft or so—of the Comet, and its reassuring rush back across the enclosures with its collision beacons winking. This was matched in drama by the sudden and steep emergence from nothingness of the Argosy C.1 at perhaps 500ft. One could almost sense the instant when the pilot went VFR. The unseen Gyron Junior Javelin howled invisibly in the shrouded distance. Bristol Siddeley's Vulcan test-bed looked far from lopsided, though said to have two Olympus 201s on one side and two 301s on the other. The dainty, gloom-dispelling passes of the Beagle Airedale, the unyapping gambollings of the Terrier, and the noisier, though chastely swift and graceful debut of the B.206, were likewise memorable.

The SC.1 went through its full range of no longer novel, but unfailingly arresting, manœuvres in all planes.

The Westland helicopters, from which everyone has come to expect teamwork at its best and most original, scored another success with the Belvedere, Wessex, Scout and Gnome Whirlwind. From the Belvedere a platoon of the Duke of Edinburgh's Royal Regiment deplaned and deployed in something like 45 seconds, after spirited covering fire from the Belvedere itself. Four ropes, two front two rear, were the intermediate lines of support. The Whirlwind set down a 2 cv vehicle on the first of two trailers behind an Alvis Stalwart. The third already bore a Saladin, and the Scout descended on to the first with (it was said) a mere foot clearance fore and aft. The Wessex was hitched up to the Stalwart, took the strain and set off up the runway with some 45 tons in tow. Later it transformed itself from a tug to an anti-submarine frigate by simulating an asdic-dip under automatic control.

Esprit de corps was the Army's motto, reflected in the mirror-image manœuvres of two formations each of four Skeeters, exemplified at the head of the page. Of this zestful performance, as of others, we hope to say more in our next report.

A Scimitar having been sent out to photograph(?) HMS *Hermes* steaming in the Channel, that mighty vessel reciprocated with three



Power for the Bristol 188: de Havilland Engines' Gyron Junior Javelin

Argosy with magic tail: the rear-loading C. Mk 1

Belle of the ball: the Beagle B.206

Arrest, but not apprehension: the Scimitar hooked by the RAE/Dunlop gear

Twenty-second SBAC Display . . .

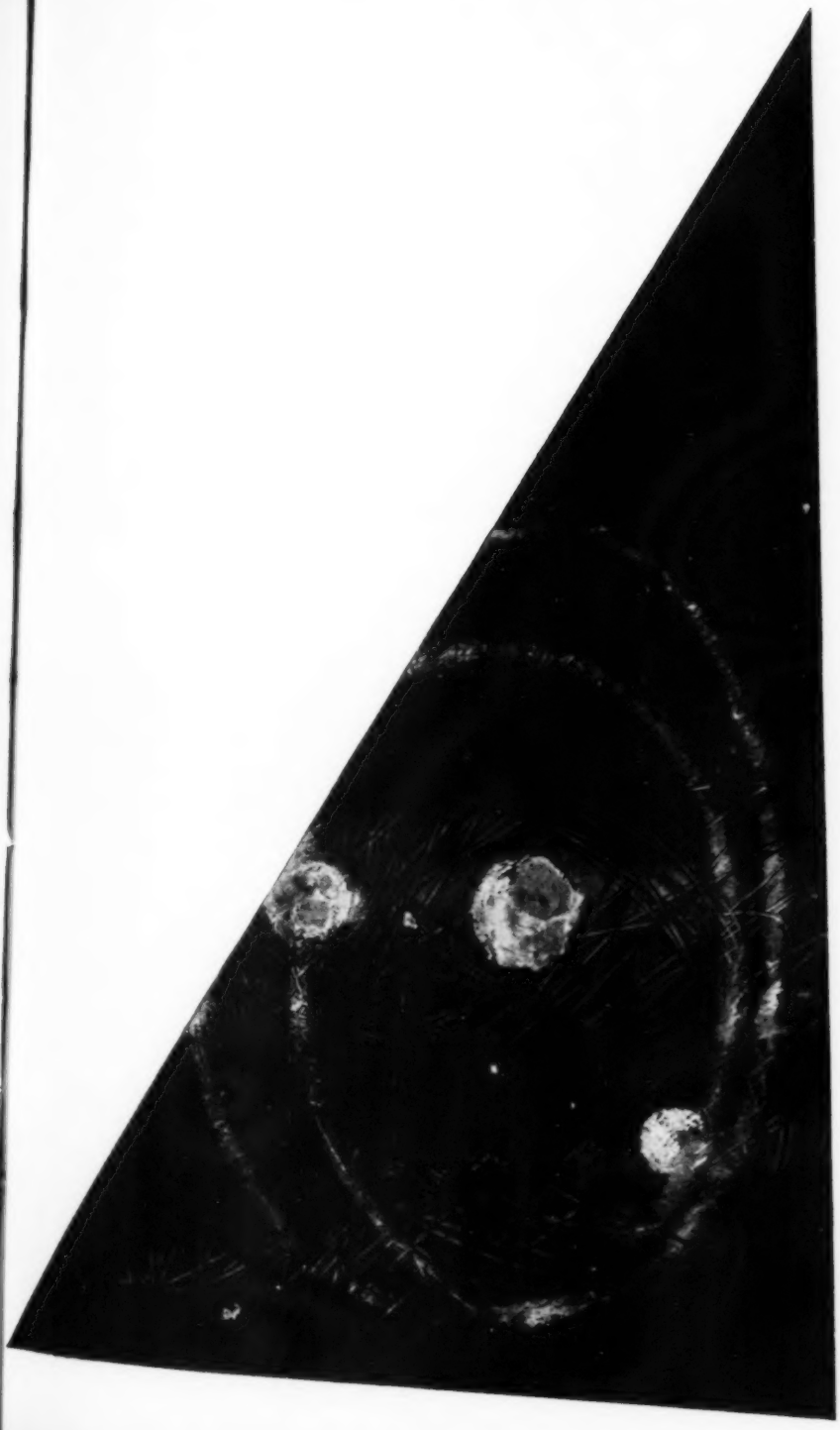
Vixens and four AEW Gannets over Farnborough. Carrier conditions were said to be some 300ft cloud-base and half a mile visibility. A pair of Vixens from Yeovilton demonstrated the buddy refuelling technique—twice—and a Scimitar arrested itself in 600ft of RAE runway by engaging the newly developed RAE/Dunlop gear.

Another out-of-the-ordinary item at runway level was a firing of the Martin-Baker rocket-assisted ejector seat—a unique British achievement demonstrated with the assistance of an "articulated dummy," and one which rendered many observers quite inarticulate.

Above, the Wessex express: 45 tons on the move; above right, launch vehicle: Martin-Baker's rocket-assisted seat leaves its mobile test-rig; below, assault with intent: the Belvedere unloads

Plessey

one of
the world's
foremost
manufacturers
of aircraft
systems
and
equipment



Plessey aircraft systems and equipment cover every type of aircraft, missile and aerospace application, ranging from complete power generation systems for the biggest jetliner to the smallest relay or connector.

Plessey research, development and production are constantly geared to the requirements of aircraft and engine designers, often contributing significantly to totally new engineering concepts.

Throughout the world, both civil and military aircraft manufacturers draw continuously on the experience of Plessey, turning naturally to an organisation which covers the whole field of pneumatic, hydraulic, electrical and mechanical systems engineering. ▷

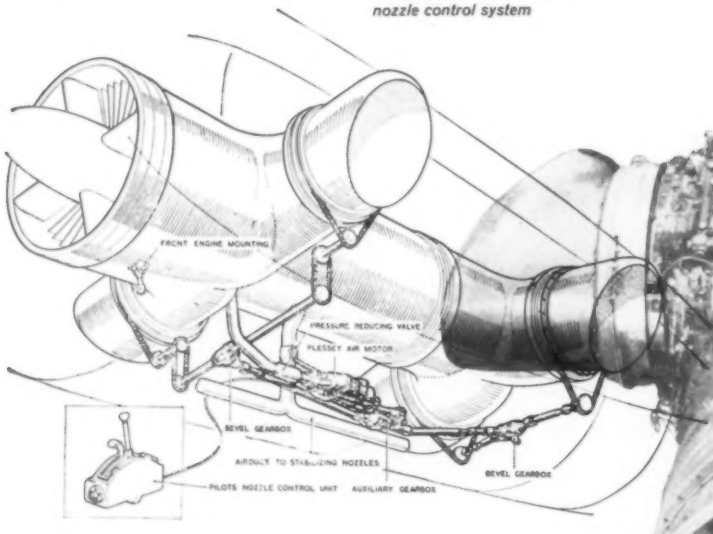
JUST THREE EXAMPLES OF Plessey ADVANCED SYSTEMS

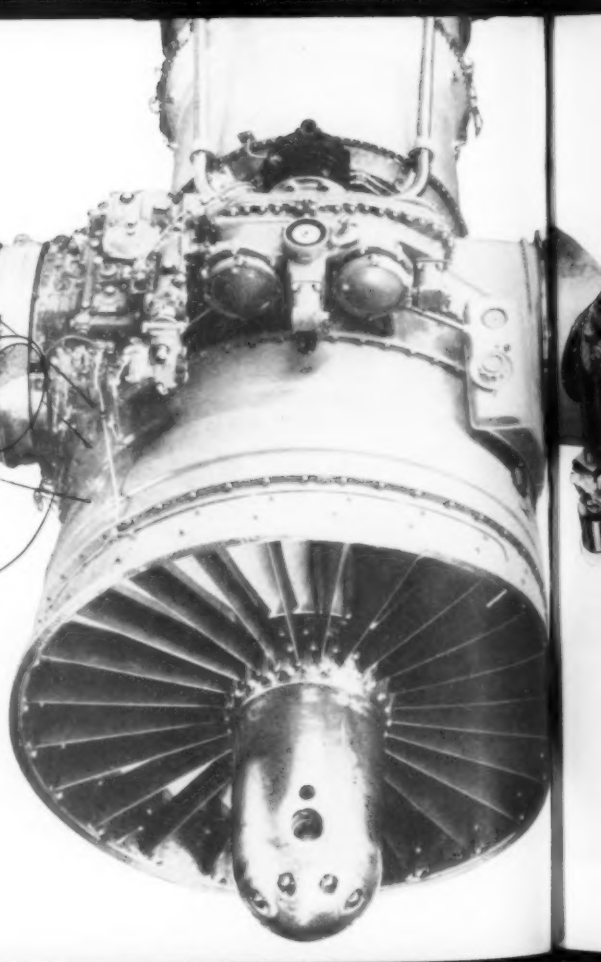
Plessey systems are continuously specified for their dependability, ruggedness—and sheer ability to cope with today's problems of higher speeds and tighter operational requirements. Plessey systems start the Canberra PR9, the Lightning, and seven marks of Hunter. As part of an impressive contribution to the Vickers VC10, Plessey provide the complete generation systems on the new BAC 'One-Eleven' not only the multichannel generation system, but the constant speed drives and starter systems are Plessey engineered. In the VTOL field—for the Hawker P 1127—Plessey again provide the constant frequency generation system, whilst Plessey pneumatics provide both muscle and the means of precise control of the swivelling nozzles.

Whenever a new concept, a new aircraft is born— Ple

1 PNEUMATIC

Pneumatic actuation and nozzle control system



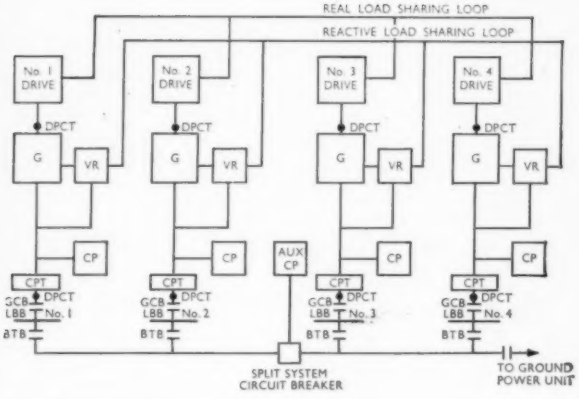


Actuation & Control System
for efflux controlled VTOL/STOL power units.

Shown here in its configuration on the Bristol-Siddeley 'Pegasus' engine, this highly advanced nozzle actuation system is completely 'fail-safe' and operates on engine bleed air. Driving the four nozzles with duplicated air motors for system integrity, the basic Plessey air motor servo unit provides rapid response and positional accuracy.

2 ELECTRICAL

Schematic is of a typical a.c. generation system for a four-engined aircraft.

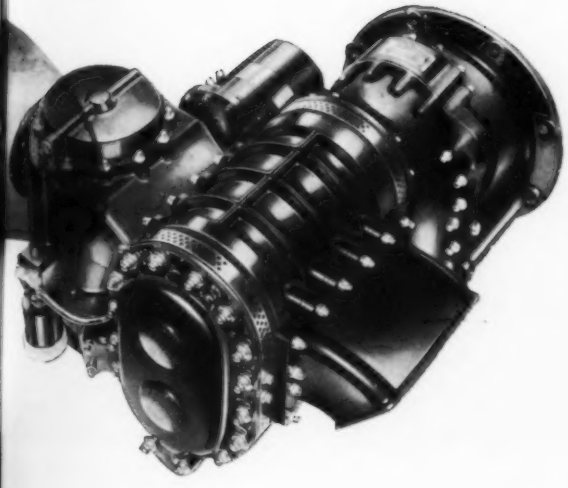


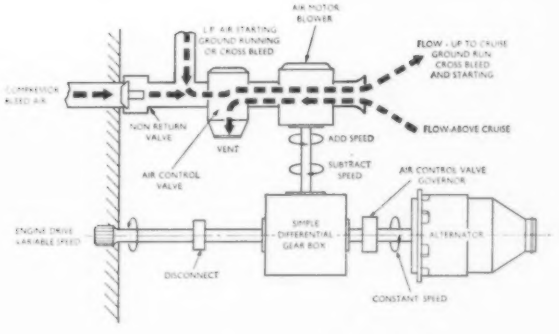
A.C. Generation Systems
–ranging from 4 kVA to 40 kVA per channel.

Plessey can supply a.c. generation systems incorporating brushless alternators of extremely advanced design, and associated control equipment which largely comprises solid-state elements. Illustrated is a schematic arrangement of a typical a.c. generation system for a four-engined aircraft. Full provision is made for generator paralleling, and for instant off-loading and load transfer under emergency conditions.

born– Plessey aircraft systems play a vital role.

3 MECHANICAL





Constant Speed Drive/Starter System–offers these important functions to the civil or military aircraft designer in one compact, highly developed unit:

Constant speed output–giving frequency control (at 400 c/s) within ± 1 c/s, and an overall efficiency in flight better than 90%.

Flight emergency services–in the event of engine failure, vital supplies maintained using cross-bled air from other engines.

Ground running–of complete aircraft electrical and hydraulic systems without running the main engines.

Air starting–of engines by simple ground connection of air supply–or self-contained by means of an APU or stored air.

High temperature screw jack, transmits thrusts up to 1,000 lb.

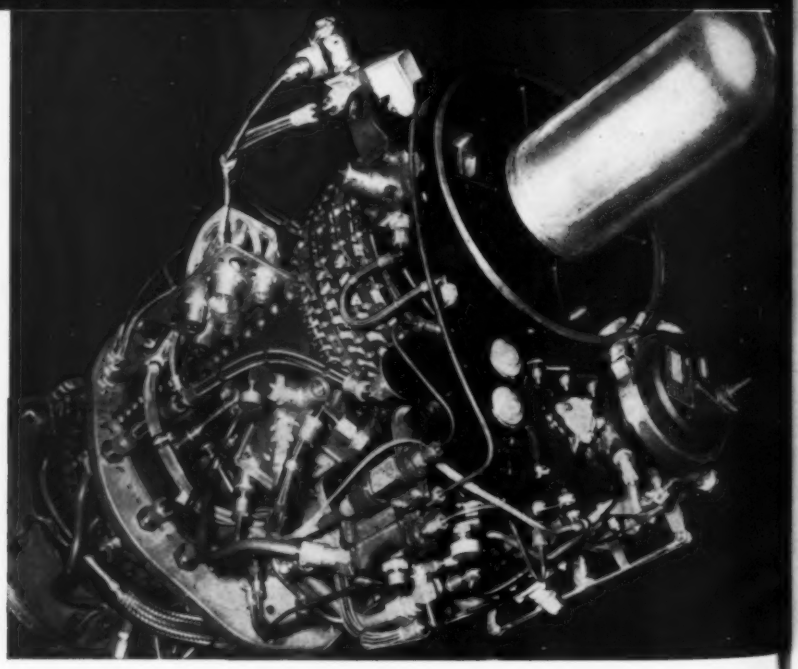
AND NOW Plessey AT 400°c

Continuous development of Plessey aircraft equipment has enabled operational temperature limits for many components and units to be considerably extended.

Already firmly established as a supplier of high temperature flexible metallic tubing and electrical connectors (up to 1100°C test), Plessey can now make available, for example, motors, actuators and relays which maintain performance up to 250°C; synchros (from the Plessey Associate Company, Ketay Limited) up to 150°C; and specific types of screw jack up to 400°C.

High temperature actuator for use up to 200°C.

The De Havilland 'Gyron' engine is fitted with both high temperature 'Plessiflex' and a Plessey preformed ignition harness.



THE PLESSEY COMPANY LIMITED

AIRCRAFT EQUIPMENT GROUP, Ilford, Essex, England. Telephone Ilford 3040

Overseas Sales Organisation: PLESSEY INTERNATIONAL LIMITED.

Planning for the future at Weybridge: BAC chief test pilot G. R. ("Jock") Bryce, left, and W. D. ("Jasper") Jarvis in the mock-up VC10 cockpit

Development and Demonstration

MEETING BRITAIN'S TEST AND AEROBATIC PILOTS

BY HUMPHREY WYNN • DRAWINGS BY GORDON HORNER

STANDING multitudinously behind the barrier near Farnborough airfield's main runway, or sitting on the warm September grass or in canvas comfort within an exhibitor's enclosure, you watch a high-speed aircraft being demonstrated at the Society of British Aircraft Constructors' flying display. With the commentator's guidance, you focus your attention on "the black sheds" (to the right) or "Laffan's Plain" (to the left), with the ping-pong automatism of a Wimbledon crowd. From the left a small shape appears, low down—"coming in very, very fast," says the excited voice through the amplifiers.

In a flash you see it, its shape contorted by shock waves: Lightning, Buccaneer or Hunter; its roar shatters your senses. Then, in the deafening silence, you realize it has gone, is again a tiny shape, possibly three miles high and almost invisible.

A few minutes later, perhaps, you are looking towards the black sheds. Low above them, almost noiselessly, comes a beautiful white shape, a great crescent or delta. As it reaches the centre of the airfield the pilot of this V-bomber opens his throttles and the Vulcan or Victor hoists itself skywards, its shape now in plan view, four black exhaust trails pencilling its deterrent progress into the peaceful Western sky.

Yet another few minutes and a jet airliner holds the stage, demonstrating qualities likely to appeal to operators and passengers: short take-off run, quietness, short landing; or, if it is a turboprop machine, visible ability to fly with one or more engines out of action. Later, helicopters rise from the grass in the centre of the airfield, like an aeronautical puppet show guided by invisible strings, a quiet performance by comparison with the jet fighters or bombers, and unlike them, using up only a local acreage of sky. Then come the Service aerobatic teams, four or nine or sixteen aircraft flying so close they look as if tied together: disciplined formation, precision timing; changing shapes against the sky, parallel plumes of coloured smoke.

This is Farnborough as we see it year by year, the SBAC Show, the British aircraft industry's annual demonstration of its wares, and the one occasion in the year when civilian test pilots come into the public eye, when the Services get an audience larger and more cosmopolitan than at any of their "at homes."

It is appropriate that the display should be held at this airfield, for Farnborough is the traditional home of test-flying in Britain. Here Cody flew precariously in 1908, Geoffrey de Havilland's biplane was given a trial in 1911, Lindemann carried out the first spinning tests, Roderic Hill set professional standards for test flying. From those years onwards, and especially since the Second World War, the name of the airfield has become known throughout the world.

One reason why its fame has been carried so far is because of the establishment there of the Empire Test Pilots' School, the centre of academic tuition as far as test flying in Britain is concerned. Annually it gives theoretical and practical training to twenty-odd Service pilots, who come in in the autumn and graduate in the summer—most of them from the RAF, but others from the Fleet Air Arm, Commonwealth air forces, and United States Navy and Air Force. The school exists under the aegis of the Ministry of Aviation, and its purpose is to supply test pilots to MoA establishments, principally those at Boscombe Down, Bedford and Farnborough itself. An ETPS-trained officer does his tour at the Aeroplane and Armament Experimental Establishment (Boscombe

Warton Johnnies: EE pilots Johnny Hackett (left) and Johnny Squier in the pilots' mess

Development and Demonstration . . .

Down) or at one of the Royal Aircraft Establishments, then is given another posting, perhaps to a squadron. Or he may (unless he has set his heart on becoming an air marshal or a naval captain) find his way into the aircraft industry as a civilian test pilot.

Make your own way, in imagination, to the other side of Farnborough airfield during the SBAC Show, to the tent where the participating pilots are having their briefing for the afternoon's flying programme. Many of these men, as you can see from the biographies published with their portraits on pages 387-389 of this issue, have graduated at the Empire Test Pilots' School and can "wear" the initials ETPS like a university degree in test flying; others, including some of the most famous, have had no such academic training.

Many of them have come into test flying direct from the Services; some of the older men (comparatively speaking, that is) entered the profession after brilliant operational careers in the Second World War. Participating with them in the Farnborough display are current RAF and Naval pilots, flying Hunters, Lightnings, Jet Provosts and Scimitars, who were hardly more than toddlers when the war ended. All have one quality in common: exceptional flying ability, coupled with complete mastery of the aeroplane in which they are performing.

All the items in the Farnborough programme, whether solo turns, co-ordinated manœuvres by two or more aircraft, or Service aerobatic teams, have to be approved beforehand by the SBAC through its flying display committee. An individual pilot has five minutes or less in which to show off his aircraft, so must think out how best to use his time.

Two outstanding performers at Farnborough in recent years have been R. P. Beamont in the Lightning and "Bill" Bedford in the Hunter. The former, with sizzling high g turns and rapid change-of-direction rolls, has managed to show off a supersonic aeroplane within the airfield area at low level. The latter in the past two years has spun the Hunter Two-Seater—all within five minutes—with brilliant use of smoke to depict its spiral descent. "Bea's" thoughts on demonstration flying (many of them similarly expressed by Bedford) are clear and sensible. First, that the aeroplane, rather than piloting skill, should be demonstrated. Every machine has some sort of feature which its designer feels should be shown to the public. With the Canberra (Bea's favourite demonstration aircraft) it was take-off performance, aerobatic ability—features stemming from its exceptionally low wing-loading and favourable thrust/weight ratio. With the Lightning, things are different. Here is an aeroplane designed to produce 1,000 m.p.h. at the tropopause, not low down; in low-level demonstration the aim is to get as close to Mach 1 as possible: "what you see is about 600 m.p.h." Tight turns and low-speed handling should be demonstrated: "One always tries to look for something another aeroplane can't do"—especially things of military advantage. As wing loadings get higher, what you can do in five minutes becomes more limited; it is all the more important to try to start the demonstration from the moment you let the brakes off—for example by using reheat on take-off, climbing rapidly, rolling into reverse direction to come back over the airfield as quickly as possible.

There you are then, waiting in the wings to begin your Farnborough demonstration: lined-up on the runway in a Lightning, taxying-out with other Scimitars of your squadron for formation aerobatics, starting your Beagle Airedale, or walking out to find your Avro 748 already full of passengers. Flying every afternoon of the week, if the weather is reasonable and your aircraft doesn't have the misfortune to go unserviceable; meeting fellow test-pilots, old friends from ETPS or squadron days. But these are salad days, compared with the bread-and-butter of everyday testing, the only time of year when the test pilot gets really publicized, unless he is involved in some sensational or tragic incident. For the other 358/9 days he is a member of a large team, co-operating closely in a rigorous flight test programme.

The sort of flying a test pilot has to do, and the conditions under which he works, vary as widely as the pilots' own backgrounds and experience. Within the last year or so there have been considerable changes through the re-alignment of the airframe manufacturing side of the aircraft industry into three big groups, British Aircraft Corporation, Hawker Siddeley and Westland.

John Towle, one of the Bristol Siddeley Engines test pilots, with behind him two of the company's test-bed aircraft: a Gnat and a Javelin FAW.7 converted to reheat

Coffee in Bristol Siddeley pilots' new offices at Filton: left is "Witt" Wittridge, one of the test pilots; right, Tom Frost, BS chief test pilot

M2 test pilot: Peter Hillwood, one of the English Electric experimental pilots, in the cockpit of a Lightning

In two of these cases, BAC and Westland, it has meant the appointment of a group chief test pilot who is in overall charge of test flying.

This change, or "rationalization" as it has been called, is physically exemplified on a door in the test pilots' offices at Wisley airfield, where Vickers-Armstrongs (Aircraft)—now part of BAC—do their test flying. The two names on the door are those of the chief test pilot, G. R. ("Jock") Bryce, and the deputy chief test pilot, R. P. Beamont. Between them they have the responsibility of forming and leading project teams for the corporation's forthcoming aircraft, VC10, Super VC10 and BAC One-Eleven (Bryce's sphere) and TSR.2 (Beamont's). There is not necessarily, however, a hard-and-fast division between civil and military projects: to gain experience, Bryce has flown a Lightning and Bea a Vanguard. Flying the TSR.2 is likely to be shared with English Electric Aviation by Vickers pilots, and it is equally probable that Hunting Aircraft will be brought in on BAC One-Eleven test flying. Vickers pilots have had a strong flair for versatility in recent years, with Valiant, Viscount and Scimitar production.

No better illustration could be gained of how a test pilot's work begins when the machine he is to fly is still a mock-up than from a hangar at Weybridge where wooden shapes of the VC10 and BAC One-Eleven stand side by side; on some days their cockpits, it has

Chief test pilot and flight development engineer of Rolls-Royce, A. J. Heyworth, at work in his office while the Tyne Lincoln takes off from the Hucknall runway

Development and Demonstration . . .

been said, are "crowded with pilots," arguing which instrument or control should go where. (In the One-Eleven cockpit there are arrows pointing to alternative positions for various instruments.) The term "crowded" is not too strong, as there are in fact a dozen pilots at the Wisley flight-test centre, and airline pilots like to have an early look at a machine they are to fly. In addition to pilots, there will be about 50 flight test observers when the VC10 gets under way. One of the advantages of test flying big aircraft is that a good many people can get aboard and carry out different kinds of work on a single sortie. Further, the fuel capacity allows longer time in the air.

One of the local difficulties Vickers-Armstrongs face, in company with many other aircraft firms, is that of a split location between factory and airfield. Even though the as-the-crow-flies distance between Weybridge and Wisley is only a mile or so, it's an unbridgeable gap for aircraft except by air. The Weybridge runway is 1,400yd long, which is short by current standards; but Jock Bryce has already decided to fly the first VC10 out: he reckons it should be easier to handle on take-off, because of powered controls, than was the first Vanguard. Such a decision, typical of those falling to a chief test pilot's lot, has only been taken after careful calculation and due consideration of all factors involved. As Bryce quite simply puts it: "One just doesn't take risks with £xm worth of aircraft." Great loyalty to his company, and a strong sense of responsibility, characterize Bryce's outlook on test flying. Commenting on the difficulty of finding new pilots of the right age with sufficient experience behind them, he stresses that the "happy-go-lucky" type is no longer wanted in these days of highly sophisticated and vastly expensive machines.

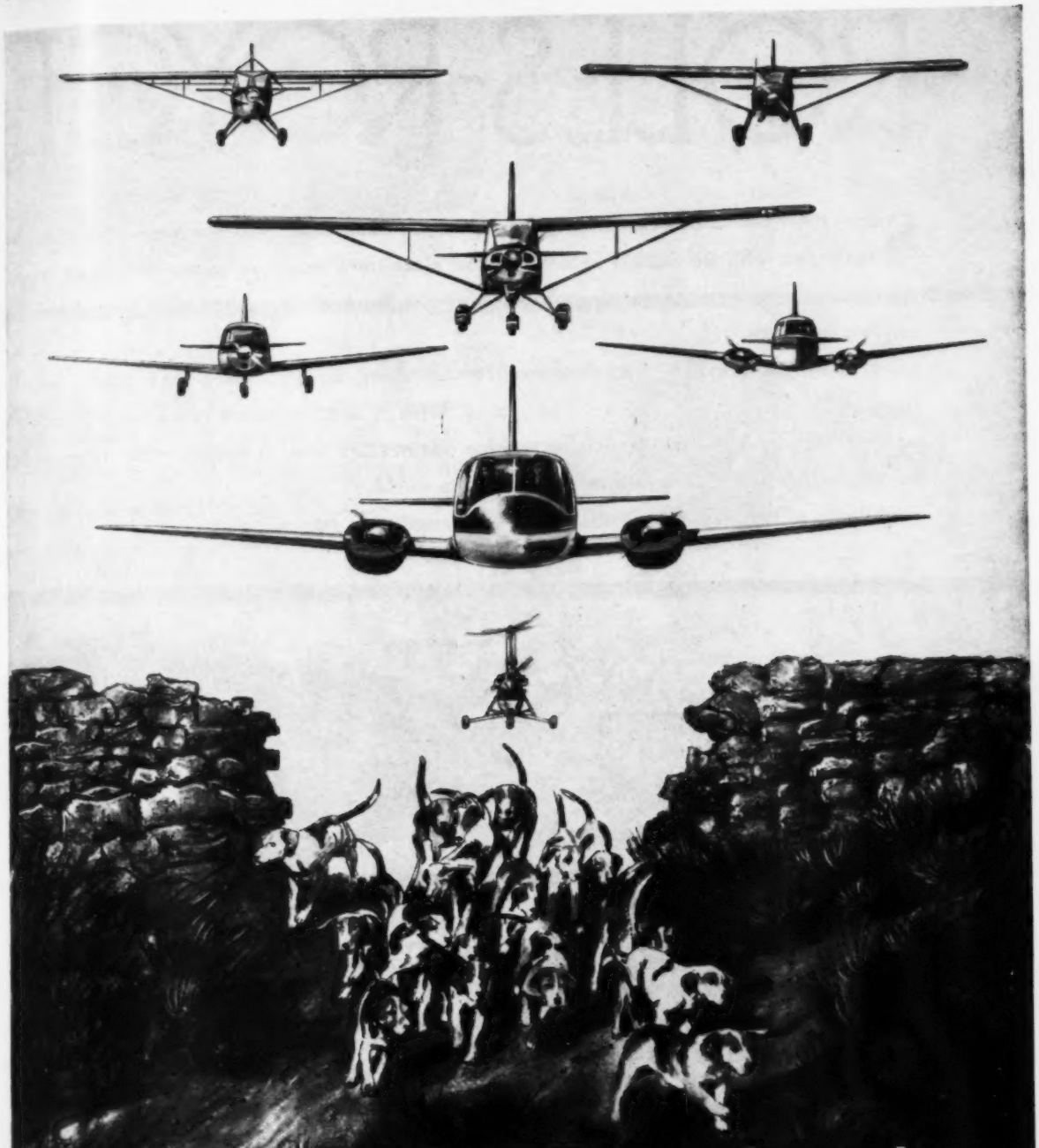
VC10 test-flying is to be done at Wisley, BAC One-Eleven test-flying at Hurn: the corporation's military project, the low-level attack aircraft designated TSR.2, is to be test-flown at Warton in Lancashire, the English Electric Aviation airfield. R. P. Beamont, in addition to his BAC responsibilities, is still manager flight operations there, with responsibility for Warton and Samlesbury (also English Electric), and still takes part in Lightning test flying, doing qualitative handling of new marks. The EE chief test pilot is Wg Cdr Jimmy Dell, who joined the company from the RAF in 1959, having previously been at Warton on secondment.

Warton is well equipped to handle high-speed test flying and its air traffic controllers, headed by Les Nicol, are well versed in recovery procedures: indeed they need to be, when six Lightnings may be airborne at one time, all with marginal endurance after test programmes have been completed. (On the average, a Lightning test flight lasts for half an hour.) For speed runs over the Irish Sea, the Lightnings do a radar climb-out towards Gt Orme's Head, then are turned north. They are given special GCI by Killard Pt radar on the Northern Ireland coast, and similar surveillance is provided by Royal Air Force radar for air-firing sorties carried out off the north-east coast. The radar stations "hand back" the aircraft to Warton when sorties are completed: there is direct telephone contact between these two centres and the airfield's radar room. To reach Gt Orme's Head, the Lightnings have to cross the confluence of Red 3 and Green 2 Airways: MoA have given permission for Warton aircraft to cross airways under radar without prior notification. For recovery, the airfield has Marconi 264H approach control radar. ILS minima are 300ft cloudbase, 1,200yd visibility; but there may be circumstances, for example low fuel reserves, when control have "got to get a pilot in," whatever the conditions. Handling Lightnings breeds special knowledge in the controllers, such as the need for getting them set on their approach path as soon as possible—for, as Dave Mitchell-Hill, No 2 in air traffic, says: "a five-degree change of direction on an approach means a 60° bank in a Lightning." In poor visibility, Warton can provide a white high-intensity centreline, plus sodium bars. The main runway is 3,100yd, including fully stressed overshoots of 200 and 250yd.

This, then, is the Lightnings' lair, which it is planned will be used for TSR.2 test flying. At present there are two experimental test pilots at Warton, Peter Hillwood and Don Knight; with Dell, they concentrate on different aspects of Lightning development. For example, Hillwood's special job has been armament; Dell has been project pilot on the weapon system. In the P.1 days, Desmond de Villiers was No 2 project pilot: now he heads the production test pilots, with Tim Ferguson, Keith Isherwood and John Hall. Production and experimental pilots are physically separated at Warton, though in fact there is no clear split between the two groups: the former have their offices in a little house which was there before the airfield; the latter are domiciled in the flight test block. Johnny Squier—who so remarkably survived high-speed ejection over the Irish Sea and paddled himself ashore in his dinghy after the world had given him up for lost—now has duties in addition to those of test flying, as crew station liaison officer. In this capacity he is responsible for liaison with the Ministries on crew stations and cockpit layout. Much of his work nowadays concerns the TSR.2: he visits Weybridge regularly and at Warton is available for consultation by the TSR.2 design staff, especially on the aircraft systems. Other pilots at Warton are Dinty Moores and Johnny Hackett (communications and delivery); Peter Moneypenny, who is a pilot and navigator; a navigator, Brian McCann, and a flight test observer, Arthur Lewry. From these men the project team for the TSR.2 will largely be built up.

Powerplant of the TSR.2 will be a pair of advanced Bristol Siddeley Olympus; development flying of such engines is done at Filton, headquarters of Bristol Siddeley Engines. Engine test-flying is quite different from the test-flying of complete aircraft, involving different attitudes and techniques. Instead of concentrating on one type of aircraft, the engine test pilot may fly six or

Lightnings' lair: a landing at Warton, the English Electric Aviation test airfield, being watched from the MoA helicopter used for ASR duties



The BEAGLES are here!

See the BEAGLE Pack — B.206, M.218, M.117, Airedale, Terrier and the Mark Eleven. Stand G, Farnborough Air Show, 3rd to 9th September.

British Executive & General Aviation Limited

Sceptre House, Regent Street, London, W.1. Telephone: Regent 3101-5

BEAGLE AERODROMES AT SHOREHAM, REARSBY AND KIDLINGTON

ROLLS-ROYCE

Since the 1960 S.B.A.C. Display, Rolls-Royce has continued to grow in size and activities, and its Aero Engine Division alone now employs 40,000 people of whom 9,500 are engaged on research and development work. In total the company has over 49,000 employees.

Exports by the company last year rose to the record level of more than £53m., largely through the sale of aero engines and spares. With 27 million hours of experience in civil and military operation Rolls-Royce turbine engines are now in service with or on order for 95 airlines and 32 armed forces around the world.

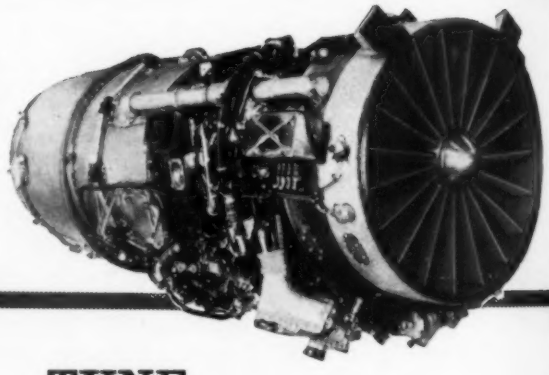
Highlights of progress with Rolls-Royce aero engines in 1961 are given here.

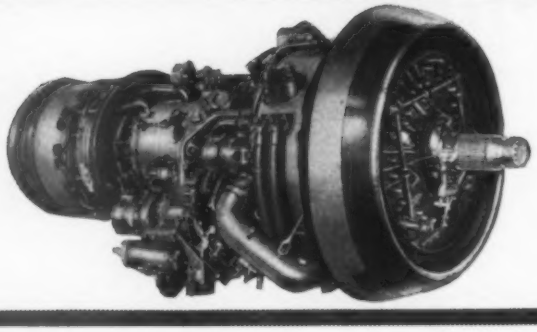
CONWAY

World record overhaul life for by-pass jets — 1,700 hours.

Development running of 20,250 lb. thrust R.Co.42 started.

Increased airline orders for VC.10 and Super VC.10.





TYNE

Introduced into airline service with BEA, TCA, Seaboard World Airlines and the Flying Tiger Line.

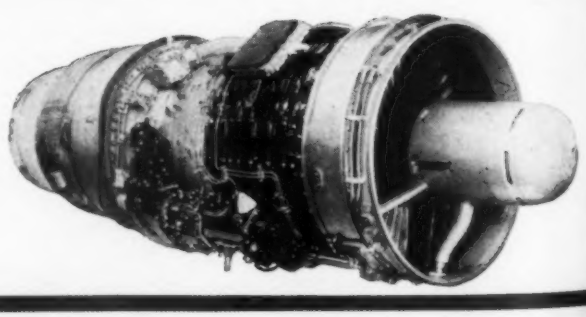
Roll-out of prototype Breguet Atlantic NATO maritime reconnaissance aircraft.

AVON

World record overhaul life for turbo jets — 2,900 hours.

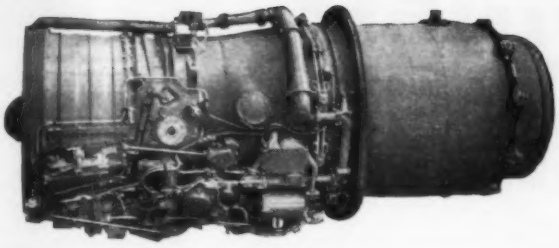
First British turbo jet on domestic services in America in UAL Caravelles.

Latest military version entered service with R.A.F. in Lightning.



ROLLS ROYCE

ROLLS-ROYCE · AERO ENGINES · MOTOR CARS · DIESEL AN



SPEY

Selected to power the new BAC One-Eleven transport.

Government development contract for military version to power Buccaneer S.2.

Ground running trials in the Trident completed.

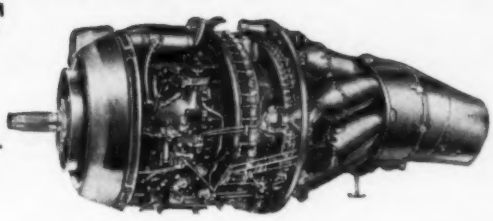
DART

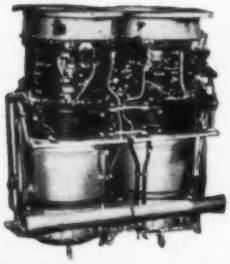
Highest overhaul life ever reached by any aero engine —3,200 hours.

Entered service in Argosy with Riddle Airlines in America.

Entered service in Herald with Jersey Airlines.

Received joint ARB/FAA type certificate at 3,030 e.h.p.





JET LIFT

Development running of RB.145 jet lift engine started.

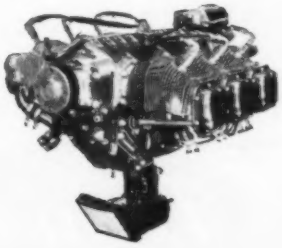
Joint development of RB.162 jet lift engine with France and Germany announced.

Rolls-Royce jet lift engines specified for military VTOL and STOL projects.

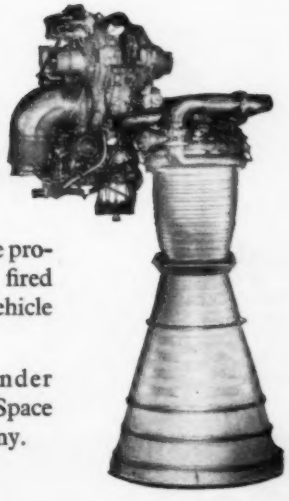
LIGHT AIRCRAFT ENGINES

Engines manufactured by Rolls-Royce under licence from Continental Motors scheduled for delivery 1962.

Several new British aircraft to be powered by Rolls-Royce Continentals.



ROCKET MOTORS



Complete Rolls-Royce propulsion system test fired under Blue Streak vehicle at Spadeadam.

Rolls-Royce founder member of British Space Development Company.

PETROL ENGINES · ROCKET MOTORS · NUCLEAR PROPULSION

REG. TRADE MARK
GRAVINER

FIREWIRE Triple FD

The optimum aircraft fire and overheat detector

DEMONSTRATION AT
STAND 219
S.B.A.C. FARNBOROUGH

* Another first by Graviner
* Responds only to temperature rise
* Will not alarm if accidently short circuited
* Uses standard FIREWIRE elements
* World wide availability
* System manufactured in U.S.A. by FENWAL, ASHLAND, MASSACHUSETTS

WINGS DAY
SEPT. 16th
GIVE FOR THOSE WHO GAVE

REG. TRADE MARK
GRAVINER

Fenwal

GRAVINER · COLNBROOK · SLOUGH · BUCKS · TELEPHONE: COLNBROOK 2345
G86A

seven types, often having unusual aerodynamic qualities because of extra weight or structural additions. Calling the roll of aircraft at Filton brings in a variety of names: Gloster Javelin FAW.7 with engines converted for reheat; English Electric Canberra used for high-altitude work on Viper 8 and 11; two Folland Gnats—a fighter on loan from the Indian Government for fuel system and other tests and a trainer loaned by the Ministry of Aviation; two Fiat G.91s from the Italian Government, one of which has now gone back to Italy; two Avro Vulcans for Olympus development flying (a Homeric-sounding activity that would have startled the Greeks); a Vickers-Armstrongs Valiant; a Ministry of Aviation Gannet 1 specially ducted to take the Mamba engine which powers the AEW.3 version; three Mk 3 Hunting Jet Provosts, one of them converted to take a Viper 11; an Avro Ashton employed on Olympus or Orpheus anti-icing tests; and a de Havilland Dove for communications duties. Bristol Siddeley pilots take turns in flying the Dove for a week at a time, to keep themselves supple on airline procedures and civil flying generally.

There are six pilots on the Bristol Siddeley side of Filton airfield, headed by the company's irrepressible chief test pilot, Tom Frost. Broadly speaking, they each concentrate on a different type of engine, though their duties may overlap. Thus, Frost and his assistant chief test pilot, "Harry" Pollitt, are responsible mainly for Olympus and Viper development flying; Mike Webber is concerned with the Orpheus, John Towle with the Sapphire and A. H. Wittridge with the Double Mamba. The sixth member of the BS flying team, Sqn Ldr J. Cruse, has only just joined the company. He came from Boscombe Down and is thus a recent example of an RAF pilot going from Service test flying into industry. He has gone to BS at a time when the pilots have moved into new and comfortable offices, with plenty of privacy for report-writing plus coffee-bar amenities.

In addition to the pilots, there are two air electronics officers at Bristol Siddeley, Mike Stubbs and Mike Parkinson, who fly with the V-bombers. About a dozen or 15 of the company's development engineers also get into the air. Flying time for the pilots varies according to the type of aircraft: a Gnat test flight lasts between 20 and 40min; Jet Provost, three-quarters of an hour; Javelin, an hour to an hour and a half.

Bristol Siddeley Engines are now an associated company of the Hawker Siddeley Group; but cross to the south side of the east-west runway at Filton (now 8,150ft long, having been lengthened specially for the Brabazon) and you are in British Aircraft Corporation territory, for BAC took over the fixed-wing aircraft and guided-weapon interests of the Bristol Aeroplane Co, which formerly had the distinction (shared with de Havilland) of being both an airframe and engine manufacturer. Now, by a curious quirk of circumstance, the de Havilland Gyron Junior engines for Bristol's all-steel research aeroplane the T.188 are coming from BAC's rivals the Hawker Siddeley Group, who control the DH Aircraft and Engine Cos through Hawker Siddeley Aviation.

Godfrey Auty, the Bristol Aircraft chief test pilot and the man responsible for flying the 188, has a large first-floor office which overlooks the east end of the main Filton runway. A 40-year-old Yorkshireman with a serious expression but a winning smile when it comes, Auty has been on the Bristol flight test staff for ten years, and succeeded Walter Gibb as chief test pilot in July last year. Gibb had been project pilot on the 188, with Auty "taking a back-seat interest"; now Auty has moved into the front seat, so to speak,

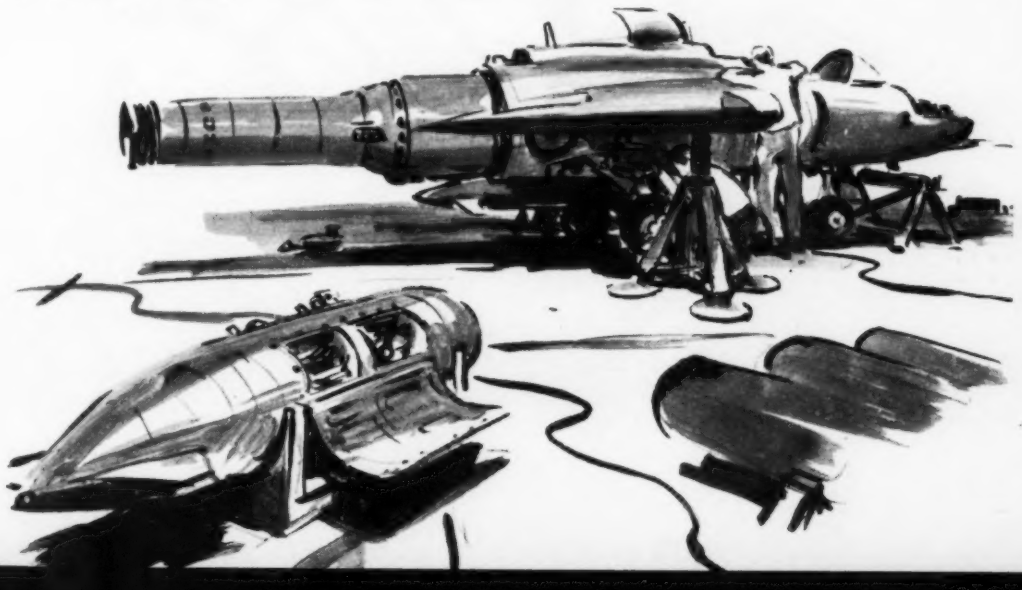
A Viper engine (outboard pod) being flown on a Canberra of BS Engines. Below can be seen the long runway at Filton, lengthened when the Brabazon flew, from which the Bristol T.188 will soon be airborne

and has been steadily preparing himself for the actual flying. This indoctrination to high speeds has included piloting an English Electric Lightning at Warton and a Fairey FD.2 at RAE Bedford; in addition Auty went to Hatfield when development flying was being done on the Gyron Junior, to familiarize himself with the engine. (He is an experienced engine test pilot, having done a lot of Bristol turbojet development flying at Filton, before Bristol Siddeley Engines was formed as a separate company.) Of the 188 he says guardedly that while the company have a rough idea of what its capabilities are likely to be, these won't actually be known until it has "performed." As to physiological problems, he does not view these as likely to be much different from those encountered in any high-speed aircraft; his preparations on this score have been no more than the annual medical check which the MoA requires all test pilots to undergo.

Although Auty has the main responsibility, three pilots in all are concerned with T.188 flying: in addition to him there are the pilot of the Hunter chase aircraft, and a third who will be acting as ground safety pilot. It is planned that, eventually, the other two will alternate with Auty in piloting the 188. Bristol Aircraft have at present three test pilots in addition to Auty: J. I. (Willy) Williamson, Ken Ashley and Lew Roberts. They are taking on another pilot to fly the President communications aircraft, and he will also share (as co-pilot) in Valiant, Britannia and Canberra flying carried out at Filton.

Most of the Bristol Aircraft and Bristol Siddeley test flying is done to the south and west of the airfield, a comparatively clear area. Filton lies under Airway Green One, which passes over at 7,000ft, then turns north-westwards. If the new airway, Amber 25,

Orpheus-engined: one of the Gnats at Filton for development work being serviced in a hangar



Rolling out a new Wessex: in the background another is airborne

comes into being next year it will pass directly over Bristol from north to south; at present aircraft flying from, say, Manchester to the Channel Islands use an advisory route. (Auty comments that he would prefer the airway; "then at least you know exactly where the aircraft are.") To the west of Filton there is a busy clutch of RAF airfields, Colerne, Hullavington, Lyneham. The city of Bristol itself, so many of whose citizens are employed at Filton or Patchway (BS Engines), is a sacrosanct area, and when landing to the west aircraft do a right-hand circuit to avoid flying over it.

Another town which has close links with its local aircraft company is Yeovil, 40 miles south of Bristol in the neighbouring county of Somerset. Westland Aircraft, which before and during the Second World War made fixed-wing aeroplanes of unorthodox and adventurous design, now concentrate entirely on helicopters and in this regard have commercial links with Bristol; for what used to be the helicopter division of Bristol Aircraft, at Weston-super-Mare, is now the Bristol Division of Westland. There was similar hiving-off from Fairey Aviation in the formation of the Westland Group, giving a Fairey Division at Hayes. The Saunders-Roe division is at Eastleigh, Southampton, and Cowes in the Isle of Wight.

As a result of this integration of all helicopter interests in the United Kingdom, Westland now have a most impressive list of test pilots. Heading it is W. H. ("Slim") Sear, group chief test pilot, with headquarters at Yeovil. At White Waltham, where the Fairey division carries out test flying, is W. R. Gellatly, deputy group chief test pilot; deputy chief test pilot at the division is J. O. Matthews. In the Saunders-Roe division there are two centres of activity, at Eastleigh where Ken Reid is chief test pilot, and at Cowes where a similar position is held by Peter Lamb. Then at Weston-super-Mare, the Bristol division, "Sox" Hosegood is chief test pilot and P. R. Wilson his deputy.

Each of these Westland centres has its team of able and experi-

Development and Demonstration . . .

Monumental landmark: test-flying a Whirlwind south of Yeovil airfield, near the war memorial on Ham Hill, a local beauty spot

Briefing a formation aerobatic team: 800 Sqn pilots at Lossiemouth during their work-up for the SBAC Show

enced rotating-wing pilots. At Yeovil are John Fay, chief instructor to the Westland helicopter training unit, Leo De Vigne (whose present responsibility is the Gnome Whirlwind), Derek Colvin, Ron Crayton and Jack Fraser. At Waltham is J. G. P. Morton, who in addition to the Rotodyne still does a lot of Gannet flying; at Weston-super-Mare, D. F. Farquharson and R. Smith; at the Saunders-Roe division, J. J. M. Jeffery and H. Phillips.

As well as their pilots, Westland must have the longest list of flight test observers in the country, perhaps only challenged by Vickers when their flight test team for the VC10s is complete. Their names resounding like a scene out of *Goodbye, Mr. Chips*, at Yeovil there are eight—Smallridge, Haller, Parfitt, Cort, Peto, Mills, Klitz, Parker; at the Fairey division 13, including the Gannet f.t.o.s and radio specialists—Darlington, Blackburn, Gibbins, Cook, Berris, Dunn, Carter, Davies, Henderson, Cardy, Wipps, Crosby, Outhwaite. At Weston, 15—Coles, Bristow, Daniell, Thickett, Shell, Williams, Parsons, Rushby, Way, Payne, White, Brieltz, Lyddon, Skeggs and Blight. At Eastleigh, six—Dick, McGuire, Wilkinson, Byers, Picot and Eggett.

"Slim" Sear, at the apex of Westland test-flying, views his large responsibilities with a certain ironic detachment which conceals an active concern for the successful progress of helicopter development in this country. At each corner of the Westland kingdom are pilots who have lived with their machines from the very beginning—Gellatly with the Rotodyne, Hosegood with the Belvedere, Reid with the Scout. There may be, in Sear's opinion, some flexibility between companies in the group as far as test pilots are concerned as production lines develop, according to requirements. For example, Scouts being built at Hayes may mean a strengthening of test pilots at the Fairey division.

There should be a longer active career for helicopter test pilots, compared with fixed-wing pilots subjected to higher g strains. With turbine engines, helicopters are now starting to go higher, so altitude comes into the picture much more than before. (It also

Helicopter world: a Westland Wessex at Yeovil having a compass swing near the control tower and test pilots' offices

Development and Demonstration . . .

means that helicopter test-flying is more likely to be affected by adverse weather.) Sear considers that the biggest strain is on a pilot's ears. As far as the recruitment of appropriately qualified new pilots is concerned, he would prefer to have "users," that is those with helicopter experience on RAF or Fleet Air Arm squadrons.

Most of the test-flying at Yeovil, which is a grass airfield on the western edge of the town, is done to the south—where Ham Hill memorial serves as a useful landmark—so as to keep clear of the jet aircraft traffic of Royal Naval Air Station Yeovilton, a few miles to the north.

The Navy is one of Westland's best customers, but it will not be showing off any of its Commando or anti-submarine helicopters at this year's Farnborough display; instead, after a Sabbatical year, the Senior Service is putting in the mighty roar of Scimitars with an aerobatic team, and the combined roar of Scimitars, Sea Vixens and Gannets in a fly-past by the carrier group from HMS *Hermes* in the Channel.

800 Sqn, who are providing the Scimitar aerobatics, are no strangers to demonstration flying: it was this squadron which in 1958 put on such a colourful and attractive show in their red Sea Hawks. Since then, of course, the squadron personnel has changed completely: two of the former members are at RNAS Lossiemouth, where 800 have been working-up for Farnborough, one as an instructor and the other with the Buccaneer intensive flying trials unit. The present CO is Lt Cdr D. P. ("Danny") Norman, an ex-Boscombe Down test pilot, who has done a splendid job in building up a team whose members had had no previous formation-aerobatic experience.

The squadron came out of *Ark Royal* on March 31, and by the time modifications had been carried out on their aircraft and personnel had had a fortnight's leave, had only five weeks to work up for the Paris Salon. Norman started with a pair of Scimitars doing aerobatics: himself and the Senior Pilot, Lt Cdr John Ford, who had had Sea Hawk aerobatic experience, or Lt G. A. I. Johnston, a very experienced ex-RAF pilot. By the time of Paris, Norman had a 4 + 1 + two spares team; and as those who were there know, they put on a brilliant show. One of Norman's display maxims is that "you should always try to do something the other fellow can't do" (*vide* Beamont and Bedford): hence, a slow flypast with arrester hook down is a natural gimmick for Navy pilots. Another is that there should be something happening all the time: hence, a "singleton" to fill in the gaps while the formation enters its next manœuvre. Norman believes that any squadron pilots can do formation aerobatics: the only difference between the better pilots and the average citizens is that the former learn more quickly. A speciality of 800 Sqn is its use of red, white and blue smoke, the only drawback being that "it's very noticeable when it doesn't work" and the right colour fails to appear in the right place. This is something mechanical and chemical; as far as the personal matters of training and technique are concerned, 800 have done everything possible. "The important thing," says their CO, who looks remarkably like Alec Guinness and briefs his pilots with an actor's wit and aplomb, "is to do some formation aerobatics every day. At the end of a sortie, call up, say 'where are you?' then link up for some aeros before landing."

There is, not unnaturally, a link between the Royal Navy and Rolls-Royce because the former are users of R-R Avons; but it has been intensified recently by the secondment to the R-R flight development centre at Hucknall of a Scimitar squadron pilot, Lt P. J. Lovick.

Lovick is on six months' secondment; at the end of that time he may become a permanent Rolls-Royce test pilot, one of the team headed by A. J. Heyworth. His deputy is H. C. Rogers (like Heyworth, a wartime bomber pilot with a distinguished record): he specializes in turboprop engines, while Heyworth has VTO and Spey engines as his special responsibility. The other pilots, with their types, are J. A. Jackson (military Avons and Tynes), A. C. Bavin (VTO, civil Avons and Conways), M. C. Muir (military Conways and Darts), D. Whitham (military Avons) and P. J. Lovick (Naval Avons and helicopters). There are also four flight engineers, headed by the chief flight engineer, J. E. Butcher. Members of his team are S. G. Ratcliffe, R. Painting and G. F. Hill.

To carry out development work, Rolls-Royce have a varied collection of aircraft at Hucknall: a Dart-engined Ambassador; Ashton carrying a Conway; Dart-powered Dakota, which has been higher (36,000ft) than a Dakota probably has ever been before; Tyne Elizabethan; RA.24R-powered Javelin; Tyne Lincoln; Lightning; Meteor with downward-thrusting RB.108; Conway Victor and Spey Vulcan.

Jim Heyworth is quick to emphasize the importance of versatility: the engine pilot must be able to fly at least five different types of aircraft; but the aircraft itself is not important, what matters is the powerplant and associated systems. Rolls-Royce are continually "putting new wine in old bottles"; Hucknall aircraft are always over-powered, are taken up higher than they were intended to be: there is commonly a lot of asymmetric flying "to absorb the power in the airframe."

Work at the Hucknall flight test development centre, as far as the pilots and observers are concerned, is being carried out on three or four fronts continuously: there is development and endurance flying; noise-suppression tests; the lift-engine programme; tropical trials; icing tests; visits to airlines all over the world using Rolls-Royce engines—"one of the few companies which meets in the cockpit." On their side, the Hucknall pilots learn a great deal from visits abroad, seeing at first hand the conditions under which their engines are operated.

Hucknall airfield itself is cleared for aircraft and pilots used to operating to ICAO standards; it has line-and-bar approach lighting

Meteor VZ608, with an RB.108 engine mounted below it, on the Hucknall runway

Avro Ashton WE670, used by Rolls-Royce as a Conway test bed, in flight during spray grid tests

and full night-flying facilities: the latter are especially necessary when intensive development flying has to be done, for example the 500hr recently carried out on the Tyne Elizabethan.

It has been on the efficiency of the Rolls-Royce Avon that the success of the Hawker Hunter as an intercepter has in part been based. At Dunsfold, the Hawker Aircraft airfield, test-flying has recently been concentrated in two directions: further development of the Hunter and conventional flying, hovering and transition trials with two P.1127s. Hugh Merewether, assistant chief test pilot, has done most of the Hunter inverted spinning trials (over 150 such spins have been completed); and has shared with Bill Bedford in P.1127 development flying.

As a result of the Hunter spinning programme test, devices have been added to the Hunter to give the pilot guidance as to what to do, for example a single-pointer altimeter showing tens of thousands of feet only. Other additions are roll lights, indicating to the pilot which way he should use aileron; an audio warning which sounds at 20,000ft; and a flashing red light which shows at 10,000ft. This kind of research is in the best traditions of test flying; its parallel is to be found in Roderic Hill's work on inverted spinning in 1921. His conclusion, published in 1922, was that "provided the pilot appreciates the correct control movements to make, recovery from the inverted spin presents no insurmountable difficulties." This report is quoted in Constance Babington Smith's splendid book *Testing Time*, and her comment applies equally well to test

Folland Gnat at the company's new test airfield, Dunsfold

Readying a P.1127 for a test flight at Dunsfold

Development and Demonstration . . .

pilots in 1961: "Behind these two brief sentences lies the whole long story of striving and perseverance and eventual success."

Behind Hawker Aircraft lies the Hawker Siddeley Group, one of whose latest subsidiaries, Folland Aircraft, has recently moved its test-flying activities to Dunsfold. The Folland chief test pilot is Sqn Ldr "Ted" Tennant, whose brilliant displays in the Gnat have always been a delightful feature of recent Farnborough displays. Ironically, the Folland Gnat is thus now sharing test-flying facilities with the Hunter, a commercial rival (before the aircraft industry's "rationalization") for contracts as trainer or ground-attack fighter.

As yet safe from any commercial feuds (MoA have ordered a number), the Bristol Siddeley Pegasus-powered P.1127 is now being tested for vertical take-off, transition and conventional flight. With a typically Hawker greyhound look, the 1127 has a cockpit which is remarkably uncomplicated. Bill Bedford, who prepared himself for flying it by studying the Bell X-14 and Short SC.1 and taking a helicopter conversion, is convinced that not all the answers have been found by Hawker's predecessors in the VTOL field, particularly on autostabilization. He emphasizes that the 1127 has been designed as "an operational aeroplane from the word go"; its definition is "a close support aircraft with secondary intercepter capability." It is essential the Services come to grips with VTOL problems; besides its operational capabilities, the P.1127 is a useful vehicle to work out ground support and logistic problems, to study the sort of surfaces from which it can be operated.

When the P.1127 comes to brilliant fruition like the P.1067 (Hunter), and when the VC10s and TSR2s appear on the scene, the work of the test pilots, the Bedfords, the Beamonts, the Bryces, remains the same in principle as it was for Hill, Bulman, Quill and all the other great test-flying figures of the past: simply, discovery of the truth about an aeroplane's performance, in an altruistic concern for the safety of its future operators.

Portent for the future: the first P.1127, XP831, hovering in the hands of Hawker chief test pilot Bill Bedford

With a
which is
self for
aking a
ve been
icularly
esigned
ition is
bility."
ns; be-
icle to
sort of

P.1067
ne, the
es, re-
and all
very of
oncern

XP831,
ef test
edford

Windscreens by **TRIPLEX**

Flight, 7 September 1961

Esso

Know your airports . . . 7

WHAT'S GOING ON AT GATWICK?

Why is it London (Gatwick) now?
Because Gatwick—forty minutes by train from Victoria and about an hour by road from Central London—is playing an increasingly important part as London's second major airport. And as the London air traffic intensifies, Gatwick enters yet another significant phase in its history which dates back more than thirty years.

Was that when they built the circular terminal?
No, that came later. The aerodrome licence was granted in 1930 and initially the field was used for club and charter flying. The circular terminal—and a new railway station—were built as part of a subsequent expansion programme and the newly-developed airport was opened in June 1936.

And what about the racecourse?
That was absorbed as part of the aerodrome when Gatwick was requisitioned by the Air Ministry in 1939. After the war the airport was operated by the Ministry of Civil Aviation as a civil Customs aerodrome but its usefulness was limited by its lack of concrete runways. On March 31, 1956, flying ceased so that conversion of the site into a major new airport could be completed. Just over two years later, on June 9, 1958, the new Gatwick Airport was opened by Her Majesty the Queen.

What goes on today?
Some twelve airlines operate regularly from the airport. Scheduled services are flown to points within the U.K., to the Channel Isles, Europe and Africa; non-scheduled flights are operated to all parts of the world. Already two airlines have established maintenance bases at the airport and the BEA Helicopter Unit has been stationed there since 1951. Apart from handling routine traffic, Gatwick continues to serve as an alternative base in bad weather for aircraft normally operating from London (Heathrow). There is a wide variety of traffic at Gatwick and Esso provides safe, swift service for its customers, with an up-to-the-minute installation in keeping with an airport which was designed and built with tomorrow well in mind.

What's this helicopter doing?
This photograph, taken on May 17, 1958, shows a BEA Westland S–55 acting as a crane to position Gatwick's rotating light beacon on an 85-ft. tower in wooded country near the airport. This delicate operation is typical of the imaginative and determined way in which problems were tackled when designing and building the new airport. In consequence, London (Gatwick) today, with its first-class lighting and radio installations, its contrasting colour scheme for runway and shoulders to give maximum assistance when landing, and its unique combination of air, rail and road transport facilities in one unit, is an inspiring example of unsurpassed service for pilots and passengers alike.

This photograph shows Gatwick in its present form: a neat, modern airport with a futuristic look. But behind the bricks and glass and concrete of today lie long years of patient planning and preparation, of courageous decisions to anticipate future demands and of rapid and resourceful execution. These are the fundamentals, as vital to the building of a new airport today as they are to the provision of an efficient fuel service for the aircraft which it handles.

What are the fundamentals behind Esso's airport service?

- Products of the highest quality, produced in Esso's great refineries at Fawley and Milford Haven
- Research to evolve new products to parallel the aviation industry's development of new aircraft and new engines
- Development of engineering requirements necessary to meet the increasing stringency of aircraft turn-round, as well as operational techniques to keep pace with the new equipment
- Control of quality, ensuring that at each and every stage Esso products are up to specification
- Experience in serving the exacting needs of aeroplanes; and thorough training to pass on the fruits of that experience to those who follow.

These are the factors which ensure that Esso maintains its reputation for safe, swift service in a world where safety is no accident and speed of service is a necessity.

Esso Petroleum Company Limited
Aviation Department
36 Queen Anne's Gate, London S.W.1
Telephone: HYDe Park 7030

Air Safari Hermes, fuelled by ESSO prepares for a night departure.

Fast turnaround at Gatwick. A Britannia of British United Airways comes to rest and awaits the imminent arrival of the ESSO refueller.

FRANCE: SA Caravelle Breguet 1150 Atlantic Transall C160 Mirage 3
SWEDEN: SAAB Lansen SAAB Draken ITALY: Fiat G91T JAPAN: Namco YS11
HOLLAND: Fokker Friendship USA: Boeing 707 USSR: Rover APU

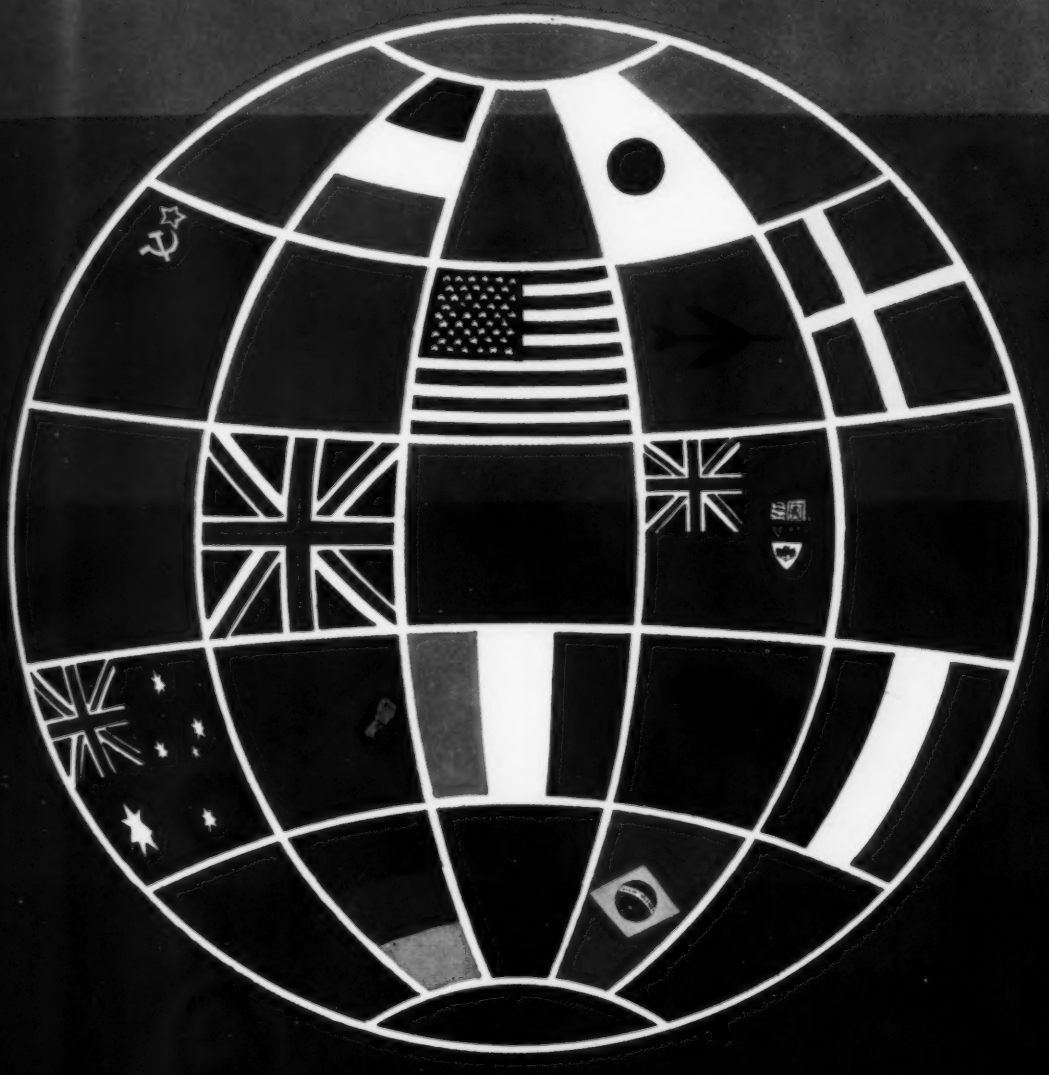
THROUGHOUT THE WORLD -

Major Continental aircraft and engine manufacturers choose Lucas fuel and combustion systems for their gas turbines and ram jet engines. In Great Britain too Lucas is in the forefront of the gas turbine equipment field. In fact the world over Lucas help to build and maintain the finest aircraft engines.

LUCAS

STAND Nos. 103-105, 124-126

Lucas Gas Turbine Equipment Limited, Birmingham and Burnley, England.
Lucas-Rotax (Australia) Pty., Limited, Melbourne and Sydney, Australia.
Lucas-Rotax Limited, Toronto, Montreal and Vancouver, Canada.
Lucas, S.A.R.L., 11 Rue Lord Byron, Paris 8e.



FRANCE: SA Caravelle Breguet 1150 Atlantic Transall C160
SWEDEN: SAAB Lansen SAAB Draken ITALY: Fiat G91T Macchi MB326
GERMANY: BMW engine type 6002 Dornier Do27 & Do28 JAPAN: Namco YS11
HOLLAND: Fokker Friendship USA: Grumman Gulfstream USSR: Rover APU

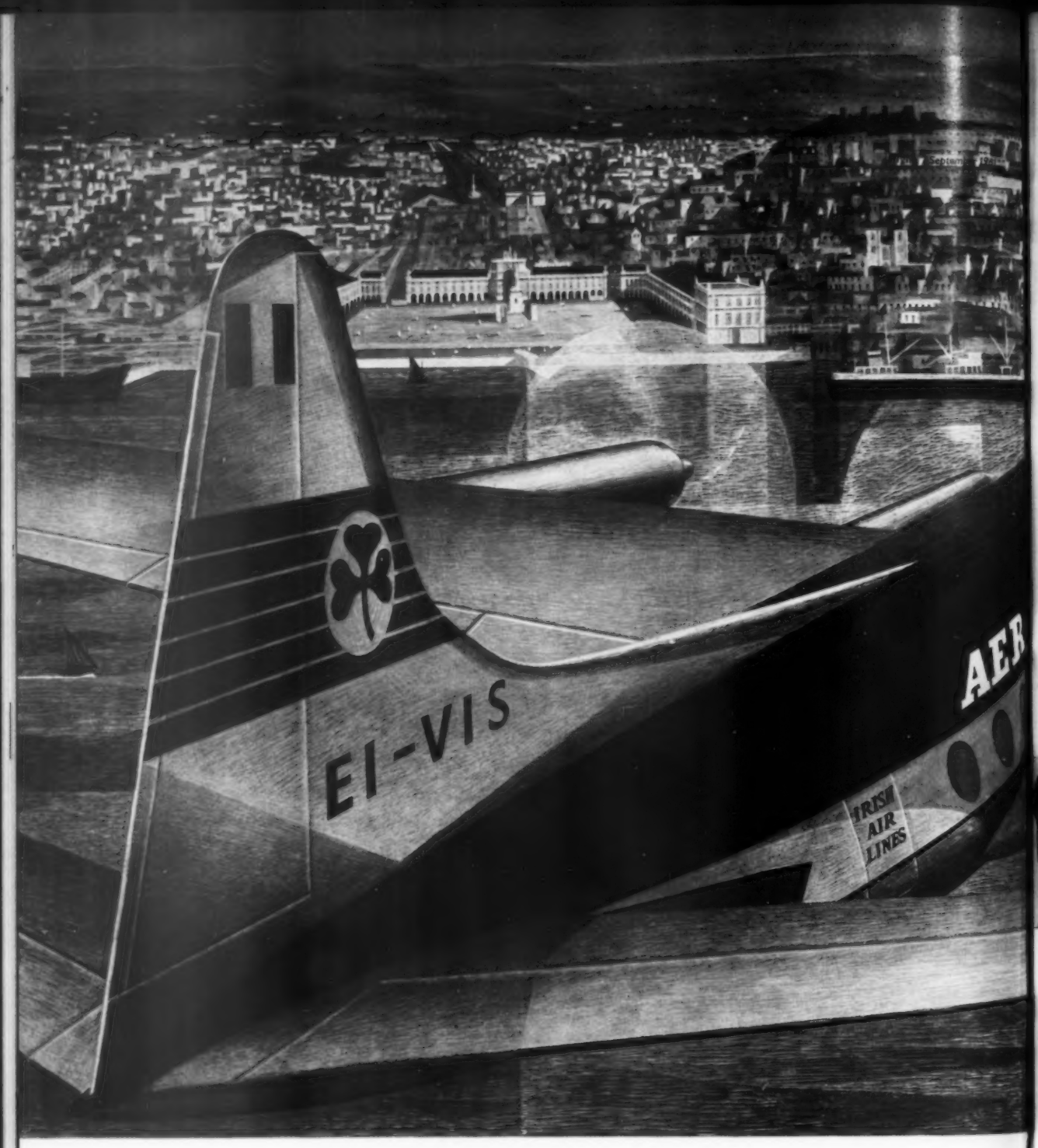
IN THE FINEST AIRCRAFT

Generating and starting systems designed, developed and manufactured by Rotax have for many years been fitted to the world's aircraft. The experience that is built into every piece of equipment Rotax produce make them Great Britain's largest exporters of aircraft electrical equipment.

ROTAX

STAND Nos. 103-105, 124-126

Rotax Limited, Willesden Junction, London N.W.10.
Lucas-Rotax (Australia) Pty., Ltd., Melbourne and Sydney, Australia.
Lucas-Rotax Limited, Toronto, Montreal and Vancouver, Canada.
Lucas, S.A.R.L., 11 Rue Lord Byron, Paris 8e.



Ten years with Aer Lingus

In the Lisbon circuit, a Viscount of Aer Lingus. From small beginnings twenty-five years ago the Aer Lingus network has grown to encompass thirty cities of Europe as well as transatlantic New York. AIR BP has served the Aer Lingus European network for ten years. At Lisbon AIR BP fuels seven major airlines with the speed and command of detail that comes of perfect teamwork and full understanding of the operator's needs.

Fast flying AER LINGUS... fast fuelling AIR BP

THE FLYING-DISPLAY PILOTS

Aircraft Company Participants

Abbreviations: *A&AEE, Aeroplane and Armament Experimental Establishment; AFRAeS, associate fellow, Royal Aeronautical Society; ARB, Air Registration Board; ATA, Air Transport Auxiliary; BAFO, British Air Forces of Occupation; CA, certificate of airworthiness; CFE, Central Fighter Establishment; CFI, chief flying instructor; CFS, Central Flying School; CGI, chief ground instructor; ETPS, Empire Test Pilots' School; FAA, Fleet Air Arm; FTS, Flying Training School; GAPAN, Guild of Air Pilots and Air Navigators; IRE, instrument rating examiner; MU, maintenance unit; OCU, operational conversion unit; OTU, operational training unit; PFF, pathfinder force; PPL, private pilot's licence; RAE, Royal Aircraft Establishment; RAFO, Reserve of Air Force Officers; RAFVR, Royal Air Force Volunteer Reserve; RAuxAF, Royal Auxiliary Air Force; TAF, Tactical Air Force; UAS, University Air Squadron; USAF, United States Air Force; VLR, very long range*

J. W. Allam (*Victor B.2*): Deputy chief test pilot of Handley Page, whom he joined in 1954 after serving with the RAF and RAFVR since 1942. Pilot of the first Victor to fly at supersonic speed; made first flight of Victor B.2 on February 20, 1959. Took No 9 ETPS course and No 5 course, Test Pilot Training Division, US Navy; with "V" Sqn, A&AEE, 1951-53.

C. Allen (*Avro 748*): After production and experimental test flying with Vickers-Armstrongs (Weybridge) from 1952-59, joined A. V. Roe and was co-pilot on the first Avro 748 flight. Served with the RAF from 1943, flying Mosquitos with 540 (PR) Sqn. After leaving the RAF in 1947, flew with Central African Airways. Then flew with BEA and at the same time was a pilot with 604 Sqn, RAuxAF.

Godfrey Auty (*Bristol Type 188*): Chief test pilot of Bristol Aircraft since July last year. Joined the company's flight test staff in 1951 and deputy chief test pilot since December 1957. Served in the RAF during the war, with 21 Sqn of 2nd TAF and with 62 Sqn of SE Asia Command. Responsible for much of the flight development work on Britannias; did a great deal of flying in connection with Bristol turbojet engine development before the formation of Bristol Siddeley Engines. Is an AFRAeS and a member of the American Society of Experimental Test Pilots.

J. W. Allam

C. Allen

Sqn Ldr P. P. Baker (*Victor B.2*): Entered RAF in 1943; flew Sunderlands (1946-49) with 201, 209 and 239 Sqns. Attended CFS course, then (1950-52) was instructor at FTS and advanced FTS. Took No 12 course, ETPS, in 1953; at A&AEE, Boscombe Down, 1954-56. Tutor at ETPS, 1957-59; in July 1959 retired from RAF to join Handley Page.

Wg Cdr R. P. Beamont (*Lightning*): Deputy chief test pilot, British Aircraft Corporation, and manager of flight operations, English Electric Aviation. Had a distinguished wartime career in the RAF, in which he served from 1938. Commanded 609 (West Riding) Sqn, with whom he introduced the day-and-night "train-busting" technique, and 122 and 150 Wings. During the anti-flying bomb offensive destroyed 32 of these weapons. Taken prisoner in 1944; on returning to this country commanded the Air Fighting Development Sqn at the CFE. Is an OBE; holds the DSO and DFC.

A. W. Bedford (*Hunter*): Chief test pilot of Hawker Aircraft, having joined the company in 1951 after being at the RAE Farnborough (1950-51). Entered the RAF in 1940 and served with 135 and 605 Sqns in the Far East; in 1944 was a flight commander at the Armament Practice Camp and the following year went to 65 Sqn, becoming a flight commander. Attended ETPS where he was OC Instrument Weather Flight in 1949. Holds many gliding records and a Gold "C" with two diamonds. Appointed Hawker chief test pilot in 1956.

A. L. Blackman (*Vulcan*): Test pilot with A. V. Roe since leaving the RAF, which he joined in 1948 after taking an Honours degree in physics at Cambridge University. Flew with 5 and 11 Sqns in 2nd TAF, then took the ETPS course, gaining a distinguished pass. With "B" Sqn at the A&AEE until August 1956.

P. O. Bugge (*Comet*): de Havilland chief development test pilot, having been with the company since 1949. Born at Kristiansund, Norway, in 1918 and entered the Norwegian Air Force in 1939. After the German invasion escaped to Britain and in 1941 joined the RAF, serving with 604, 255 and 85 Sqns (Beaufighters and Mosquitos). In December 1955 co-pilot of the Comet 3 on its round-the-world flight and in 1959 of the 4B which won a special prize for "originality and ingenuity" for a BEA syndicate in the *Daily Mail* race from London to Paris.

J. G. Burns (*Buccaneer*): Joined Blackburn Aircraft in January 1959 after being with Hunting Aircraft since February 1958. Previously served in the RAF, which he entered in 1946 as a Cranwell cadet. With 56 Sqn; went to CFS in 1951; took No 13 ETPS course in 1954; at the A&AEE from 1956 to 1957. Has been awarded two Queen's Commendations for Valuable Services in the Air.

W. R. Burton (*Dart Herald*): Joined Handley Page in 1948. Served with the RAF 1938-39, then EFTS instructor until the outbreak of war, when he rejoined the RAF and served in Training Command in Canada, Atlantic Ferry Training Command, Coastal Command VLR Sqn and HQ Coastal Command. In 1945 joined BEA and flew Vikings.

Gp Capt J. Cunningham (*Comet*): de Havilland Aircraft chief test pilot since 1946 and a director since 1958. Started flying for the company in 1938. Served in the RAF, becoming the highest-scoring (20) night fighter pilot. First flew the Comet in 1949 and has subsequently set up many records with these aircraft. Chief pilot on the Comet 3 world flight in 1955; in 1958 captained a Comet 4 on the fastest-ever Atlantic crossing by an airliner and the fastest long flight (Hong Kong to London in daylight, 16hr 16min flying time). Is an OBE and DL; holds the DSO and two Bars and the DFC and Bar.

Sqn Ldr L. De Vigne (*Gnome Whirlwind*): Test pilot with Westland Aircraft since 1953, having served in the RAF from 1940 to 1951. Won the DSO and DFC serving with 627 Sqn (Mosquitos) in the PFF. Test pilot with 41 Group, Maintenance Command, 1945-46; took No 6 ETPS course, 1947; Service and civilian test pilot with RAE Farnborough, 1948-52, being awarded AFC. Chief test pilot, Armstrong Siddeley Motors, 1952-53. Carried out initial test flights on the deflected jet Meteor (Nene).

Godfrey Auty

Sqn Ldr P. P. Baker

Wg Cdr R. P. Beamont

A. W. Bedford

A. L. Blackman

P. O. Bugge

J. G. Burns

W. R. Burton

Gp Capt J. Cunningham

Sqn Ldr L. De Vigne

Wg Cdr J. L. Dell

W. H. Else

E. G. Franklin

Sqn Ldr W. R. Gellatly

Sqn Ldr J. G. Harrison

O. J. Hawkins

Sqn Ldr H. G. Hazelden

C. T. D. Hosegood

T. Howard

J. W. C. Judge

THE FLYING-DISPLAY PILOTS . . .

Wg Cdr J. L. Dell (*Lightning*): Chief test pilot of English Electric since January this year, having been deputy chief test pilot from December 1959. Had previously (from 1957) been Fighter Command liaison officer, taking an active part in the development programme of the Lightning. Joined the RAF in 1942; has been a flying instructor and completed a tour of operations with the USAF (1952-54).

W. H. Else (*Argosy*): Joined Armstrong Whitworth as a test pilot in 1947. Served with the RAF from the age of 20, doing his initial training in Britain and becoming one of the first English pilots to train in the US. Flew fighters and fighter-bombers during the war, doing low-level attacks on pin-point targets. Was appointed to an OTU and then seconded to do armament trials at Boscombe Down. After joining AWA, attended the ETPS. Flew as second pilot on the Apollo's first flight and has also flown prototype machines for the company.

E. G. Franklin (*Argosy*): Chief test pilot of Armstrong Whitworth Aircraft since January 1948, having re-joined the company (with whom he had been an apprentice) in 1945 as a test pilot. Served during the war with 78 and 35 Sqns (Whitleys and Halifaxes), winning the DFC and being awarded the AFC for instructional duties. Started test-flying in 1942, before completing a second tour of operations (in the PFF). Attended No 2 course at the ETPS in 1944, before going to the A&AEE and then to AWA.

Sqn Ldr W. R. Gellatly (*Rotodyne*): Joined the RNZAF in 1940. Between 1942 and 1945 did 77 light bomber and GR operations; from October 1944 to July 1945 commanded 293 Sqn RAF; permanent commission, May 1947. CGI at 231 OCU, 1947-48; flight commander, 139 Sqn, until February 1950. ETPS course, 1950; helicopter flight commander at A&AEE, 1951-54; RAF Staff College course, 1954-55, then joined Fairey Aviation. Council member, Helicopter Association, 1953-55 and May 1956-May 1959.

Sqn Ldr J. G. Harrison (*Avro 748*): Chief test pilot of A. V. Roe since January 1958; joined the company as a test pilot in February 1954. Entered the RAF as an apprentice in 1935; started flying in 1941. Completed training in Canada and became an instructor there. In 1944 posted to a Mosquito OTU and then served with 605 Sqn in 2nd TAF. ETPS course, 1949; joined the aerodynamics flight at the RAE, being awarded the AFC. Has flown 87 types of aircraft.

O. J. Hawkins (*Vulcan*): In 1958 joined A. V. Roe after test flying with Gloster Aircraft Co. Served with the RNZAF in 1942, flying P.40s and Corsairs; came to England in 1951 to join RAF. Appointed to RAE (1954) and subsequently to ETPS. After completing the course, flew with "A" Sqn at Boscombe Down.

Sqn Ldr H. G. Hazelden (*Dart Herald*): Appointed chief test pilot of Handley Page three months after joining the company in 1947. Flew Hampdens with 44 Sqn during the war, winning the DFC and BAR. Subsequently instructed at 14 OTU then went to 83 Sqn. Took the ETPS course and went to the A&AEE, later commanding the Heavy Aircraft Test Sqn. Appointed OC the Civil Aircraft Test Section and awarded a King's Commendation. Received the Queen's Commendation in 1958.

C. T. D. Hosegood (*Belvedere*): Bristol Aircraft chief helicopter test pilot since 1951. Served in the Fleet Air Arm during the war, being appointed to the first armed merchant cruiser to be fitted with a catapult. One of the first Naval pilots sent to the USA for helicopter training, serving with various experimental units after his return to the UK in mid-1944 and on loan to the RAF at Beaulieu, where the Helicopter Experimental Unit originated. Joined the Bristol Aeroplane Co in 1948, to assist in helicopter test and development flying.

Trevor Howard (*Airedale*): Senior pilot and engineer-in-charge flight trials, Beagle-Auster. Learned to fly with Nottingham UAS while at Loughborough College, of which he holds a diploma. Served in the RAF from 1948-49, gaining his wings in 1949. Joined Auster in 1951 as an aerodynamicist; became chief aerodynamicist at Rearsby in 1959 and this year was appointed senior pilot. Is an AFRAeS.

J. W. C. Judge (*Terrier*): Test pilot with Beagle-Miles at Shoreham since early this year. Served in the RAF during the war with 33 and 245 Sqns, after the war with 615 Sqn, RAuxF. Holds Queen's Commendation for valuable service in the air. Took his PPL in 1947; well known as an air racing pilot.

J. O. Lancaster (*Argosy*): Test pilot with Armstrong Whitworth Aircraft since 1949, having been an apprentice with AWA in 1935. In 1937 joined the RAFVR and after the outbreak of war did a multi-engine conversion course. Flew with Bomber Command and took part in the daylight raid on Brest. Was awarded the DFC. With the A&AEE, Boscombe Down, then joined Boulton Paul as a test pilot. Later transferred to Saunders-Roe and flew the SRA.1.

J. G. McCowan (*Argosy*): Test pilot with Armstrong Whitworth Aircraft. Joined the RAF as a Boy Entrant and in 1938 volunteered for flying duties. Did his flying training in Canada and returned to England in 1943. Served in India and Singapore, flew with a fighter squadron on the North-West Frontier and later became a rocket-firing instructor. After leaving the Service, was maintenance test pilot with Airwork before joining AWA.

H. C. H. Merewether (*Hunter*): A South African who joined Hawker Aircraft as a test pilot in 1954 after serving with the FAA (1943-46) and being trained as a pilot by the US Navy (1944-45). In the RAFVR (1947-51) and with 615 Sqn, RAuxAF (1951-56). Before joining Hawker was with Vickers-Armstrong as a technician in the research and development dept.

Lt Cdr J. G. P. Morton (*Rotodyne*): Joined Fairey Aviation as a test pilot in September 1955, having previously been lent to the company by the Royal Navy, which he joined in 1943. Received flying training with the US Navy, then became a flight commander in 1835 Sqn (1944-45), later serving in HMS *Colossus* and *Theseus*. Flight commander, helicopter flight, Underwater Development Establishment (1949-50); subsequently at CFS, with 705 Sqn, at the A&AEE and in HMS *Centaur* until lent to Fairey Aviation in March 1955.

P. Murphy (*Victor B.2*): Joined Handley Page in 1958 after being with Vickers-Armstrongs (Aircraft) since 1951 as an experimental test pilot, engaged in Valiant and Viscount development. Had previously served in the RAF, qualifying as a pilot in 1947 and from 1948 to 1951 serving with 56 and 66 (day-fighter) Sqns. Was aerobatic team leader and, flying Meteors, took part in many displays including that for the Festival of Britain in June 1951.

John Nicholson (*Beagle 206*): Flight operations manager, Beagle Group, since June this year. Formerly (from January 1957) chief test pilot, de Havilland Engine Co. Ex-Boscombe Down pilot and CFS examiner. Member of the SBAC Test Pilots Committee.

J. O. Lancaster

J. G. McCowan

H. C. H. Merewether

Lt Cdr J. G. P. Morton

P. Murphy

J. M. Nicholson

R. M. Oliver

S. B. Oliver

G. R. I. Parker

R. M. Oliver (*Gnat Trainer*): Joined Folland Aircraft as a test pilot in 1957. Flew fighter aircraft during the war with the RAF (from Malta) and after the war with 600 (City of London) Sqn, RAuxAF. Before joining Folland was chief development engineer with the Connaught Engineering Co, working on and driving Grand Prix racing cars.

S. B. Oliver (*Jet Provost*): Chief test pilot of Hunting Aircraft, which he joined in 1954. Entered the RAF in 1942 and was commissioned in 1945, transferring to the Royal Navy (Air Branch) later that year. Did an instructor's course at the CFS and took the ETPS course in 1950. Was Naval test pilot at the A&AEE (1951-52).

G. R. I. Parker (*Buccaneer*): Having served in the RAF and FAA and been a test pilot at the RAE, joined General Aircraft in May 1948. His flying there included the tail-less glider, and whilst with Blackburn & General Aircraft he carried out the first flight of the H.P.88, the Victor scale model. Holds the DFC and Bar, AFC, DSM and a King's Commendation and has twice been mentioned in despatches.

James Pollitt (*Vulcan*): Assistant chief test pilot, Bristol Siddeley Engines. Joined Armstrong Siddeley Motors as development test pilot after leaving the RAF in 1956; specialized in Sapphire 7 and Sapphire 7 reheat development flying in Hunters, Javelins and Canberras. In the RAF, staff instructor at CFS with A2 category and IRE on Vampires, Meteors and Hunters. Member 605 Sqn, RAuxAF, 1956-57.

J. Pollitt

R. L. Porteous

R. L. Porteous (*Beagle AOP.11*): Sales manager, Beagle-Auster Ltd, formerly sales director (from 1956) and chief test pilot (from 1948), Auster Aircraft. Learned to fly at Hatfield in 1935 and before the war was flying instructor, junior test pilot and sales representative with Phillips and Powis (Miles) Aircraft, Reading. In the RAFO from 1937 onwards; president of the Central Examining Board, Rhodesia, 1944-45; manager and CFI, Derby Aero Club, 1947-48. In 1947 set up a 100km closed circuit record in a Chilton.

K. M. Reed (*Scout*): Appointed Saunders-Roe chief helicopter test pilot in 1958, having joined the company in 1952 as senior helicopter test pilot. On July 14, 1959, became the first helicopter pilot to be awarded a GAPAN Master Air Pilot (Test Pilot) Certificate. Served with Imperial Airways before joining the FAA in 1941. Two years later took a helicopter flying course in the US and in 1944 a helicopter maintenance test pilots' course. Formed No 1 RN Helicopter Flight in 1945; two years later formed and commanded 705 Sqn. In 1949 joined Westland Aircraft as senior helicopter test pilot.

R. N. Rumbelow (*Jet Provost*): Joined Hunting Aircraft in April 1957 after serving in the RAF since 1951. Was with 208 Sqn in the Middle East from 1953 to 1955, then a flying instructor for the following two years. Winner of the Wright Jubilee Trophy for aerobatics in 1956.

W. H. Sear (*Wessex*): Seconded to Westland Aircraft in 1953 after completing the ETPS course in 1951 and being posted to "C" Sqn, A&AEE, Boscombe Down. Served in the RAF from 1942 to 1945, transferring in the latter year to the FAA, in which he was with 891 and subsequently 812 and 816 Sqns. After taking a CFS course was appointed Naval instructor at RAF Syerston.

C. W. Simpson (*Argosy*): Joined Armstrong Whitworth Aircraft as a test pilot after being on the RAF handling squadron at Boscombe Down. Originally joined the RAF in 1942, training in Canada and staying there as a flying instructor until 1944. Next year transferred to the FAA and on demobilization returned to Loughborough College. Spent two years as a technical assistant with Bristol Aero Engines then rejoined the RAF in 1950, serving as an instructor with Flying Training and Coastal Commands (1951-56) before going to Boscombe Down.

Denis Tayler (*Short SC.1*): Chief test pilot of Short Bros since April 1 this year, having previously done a considerable amount of SB.5 and SC.1 test flying for Shorts, by arrangement with the MoA, while at RAE Farnborough. Served during the war with Nos 50 and 139 Sqns of Bomber Command, doing some 100 operational sorties. Posted to RAE Farnborough in July 1945 to fly German aircraft back to England; subsequently joined the establishment's Experimental Flying Department. Flew with the Radio and Aerodynamic Flights, handling most of the post-war British research aeroplanes.

Sqn Ldr E. A. Tennant (*Gnat Trainer*): Chief test pilot of Folland Aircraft, having joined the company in June 1953. Served with the RAF during the war in 256 Sqn (Defiants) and 257 and 263 Sqns (Typhoons) and was awarded the DFC. In 1949 went to ETPS and thence to the A&AEE at Boscombe Down, where he remained until joining Folland Aircraft.

P. W. R. Varley (*Argosy*): Test pilot with Armstrong Whitworth Aircraft, which he joined after four years with Gloster Aircraft, where he was deputy chief test pilot. In the RAF from 1941, flying with 89 Sqn in Singapore. Left the Service in 1947, but rejoined the following year, with a permanent commission. Flew Hornets with 19 Sqn, took CFS and ETPS courses and was with "A" Sqn at the A&AEE.

P. M. R. Walton (*Argosy*): Started test flying with Armstrong Whitworth Aircraft in 1953, after a short time on the company's design staff. Joined the RAF in 1942 and later instructed at South Cerney and Church Lawford. Left the Service in 1948, obtaining a BSC at Birmingham University in mechanical engineering. Joined 605 (County of Warwick) Sqn, RAuxAF, in 1949, becoming CO in 1951.

D. J. Whitehead (*Buccaneer*): Qualified as a pilot in the RAF in May 1945, three months later transferring to the Royal Navy, his service including a wide experience of many different types of aircraft. Took ETPS course in 1954, and the following year appointed to the Naval Test Squadron at Boscombe Down, where he flew 41 different types and evaluated the Scimitar from the first prototype and deck-landing assessment through to CA release. Awarded AFC for this work. Was Lt Cdr on a permanent commission before retiring from the Navy to join Blackburn.

P. R. D. Wilson (*Belvedere*): Joined Bristol Aeroplane Co as a test pilot in 1952 and engaged in test-flying the Sycamore, 173 and 192 helicopters. Learnt to fly in Cambridge in 1945 whilst serving as a regular Army officer; in 1946 joined the Airborne Forces Experimental Establishment at Beaulieu, returning there in 1949 as the Army helicopter test pilot.

K. M. Reed

R. N. Rumbelow

W. H. Sear

C. W. Simpson

Denis Tayler

Sqn Ldr E. A. Tennant

P. W. R. Varley

P. M. R. Walton

D. J. Whitehead

P. R. D. Wilson

74 Sqn: leader, Wg Cdr John Howe

Service Aerobatic Teams

THE FLYING-DISPLAY PILOTS . . .

FOUR Service aerobatic teams are participating in this year's display, three from the Royal Air Force and one from the Fleet Air Arm. 74 Sqn is putting on nine Lightnings, 92 Sqn sixteen Hunters, 800 Sqn of the FAA nine Scimitars, and the Central Flying School four Jet Provosts. All these teams have participated in flying displays in the United Kingdom and Europe during this year

92 Sqn: leader, Sq Ldr Brian Mercer

800 Sqn: leader, Lt Cdr "Danny" Norman

"Flight" photograph

Central Flying School: leader, Ft Lt Frank Brambley

Airliners, transports, trainers, bombers, fighters, missiles, space probes—in service all over the world...

...AND BRISTOL SIDDELEY SUPPLY THE POWER

BRISTOL SIDDELEY AERO-ENGINE APPLICATIONS

Olympus turbojet powers...
Avro Vulcan Mks 1 & 2 V-bombers
BAC TSR 2 tactical/strike aircraft

Pegasus turbofan powers...
Hawker P 1127 VTOL strike aircraft
Fokker/Republic VTOL fighter

Sapphire turbojet powers...
Gloster Javelin all-weather fighter
Handley Page Victor Mk 1 V-bomber

Orpheus turbojet powers...
Fiat G 91 strike fighter
Fiat G 91 T trainer
Folland Gnat light fighter
Folland Gnat trainer
Fuji TIF 2 trainer
Hindustan HF 24 fighter

Viper turbojet powers...
De Havilland DH 125 executive transport
Piaggio/Douglas 808 executive transport
Hunting Jet Provost trainer
Macchi MB 326 trainer
GAF Fairey Jindivik target drone

Proteus turboprop powers...
Bristol Britannia airliner
Bristol Britannia military transport

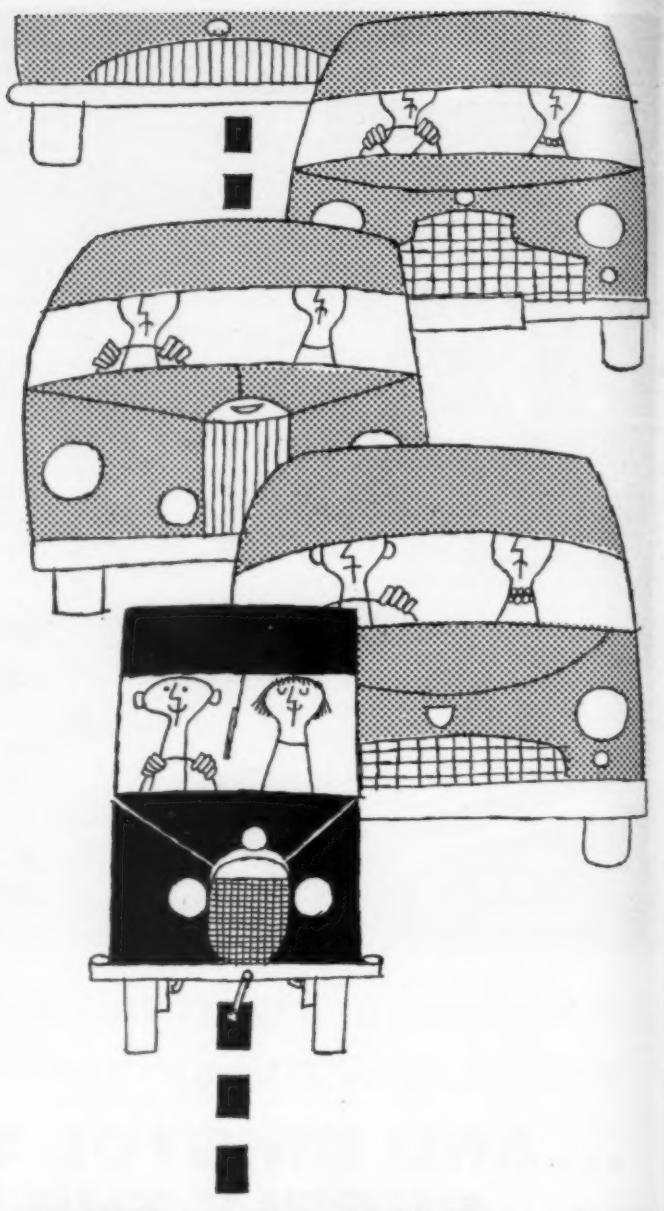
Thor ramjet powers...
Bristol/Ferranti Bloodhound guided missile

Gamma rocket engine powers...
Saunders-Roe Black Knight space probe

Stentor rocket engine powers...
Avro Blue Steel stand-off bomb

BRISTOL SIDDELEY ENGINES LIMITED—
one of the largest producers of motive power units in the world

CENTRAL OFFICE: MERCURY HOUSE, 195 KNIGHTSBRIDGE, LONDON SW7
AERO-ENGINE DIVISION: PO BOX 3, FILTON, BRISTOL, ENGLAND. POWER DIVISION: PO BOX 17, COVENTRY, ENGLAND



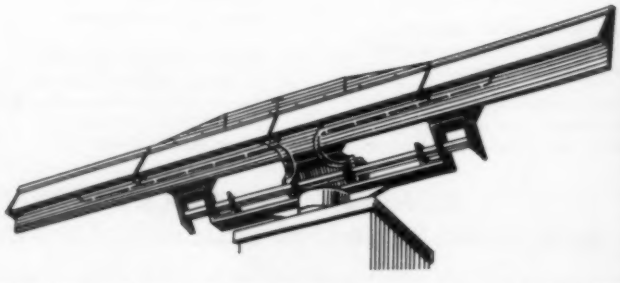
AN AID TO ACCURATE ALIGNMENT

Cossor Secondary Surveillance Radar is a co-operative system which extends ATC capacity by giving flight information automatically. Aircraft participating carry a small transponder which responds to interrogations from the ground by automatically transmitting a coded reply. Since the system does not rely on low energy echo pulses, excellent ranges are obtained at moderate power levels, and the radar display is at all times entirely free from ground clutter and rain echoes. Maximum reliable range of the system is 200 n.m. at 30,000 feet. The ground element of the Cossor system, SSR 4G, is designed in accordance with the recommendations of the International Civil Aviation Organisation and incorporates a two-pulse system of side lobe suppression. SSR 4G can be converted to the American FAA-proposed three-pulse system, should this prove necessary.

SECONDARY RADAR SSR 4G

COSSOR

RADAR AND ELECTRONICS LIMITED



COSSOR THE PINNACLES, ELIZABETH WAY, HARLOW, ESSEX, ENGLAND · TEL: HARLOW 26862

R4

CANADAIR CL-41 in the Air

BY MARK LAMBERT

No 152 of the series

NOW coming forward into the international sales arena is Canadair's two-seat basic trainer, the CL-41. An order from the RCAF is expected at any moment—by the time this appears it may actually have been announced—and the prototype is now well into an extensive European sales tour in Sweden, Germany, Switzerland and Belgium.

Although the programme has lagged somewhat because of the uncertainty of the Canadian military market during recent years, the CL-41 design team has always enjoyed the closest co-operation with the RCAF. In addition, there are several versions of the basic type, each of which can fill a real NATO, as well as a Canadian, need. The CL-41A is the pilot trainer, capable of replacing the present basic and applied trainers; the CL-41R (*Flight*, June 8, 1961, page 806) is an advanced systems trainer, with the full Autonetics Nasarr radar and inertial system which is standard in the F-104G; and the CL-41G has a not inconsiderable weapons capability.

Two other factors make the aircraft particularly attractive. First, the RCAF specified an airframe life of no less than 15,000hr, so that the aircraft is extremely strong; they also required operation in extreme cold. Secondly, the Pratt & Whitney JT12 (military: J60) turbojet has now been widely adopted, and the derated version proposed for the CL-41A will have an overhaul life of 1,000hr as soon as it enters service. The full thrust rating will be available for the heavier CL-41 versions.

In addition, the CL-41 design team included from the start Canadian test pilot Ian MacTavish, a man of considerable proportions and great experience; and the cockpit has been designed to accommodate comfortably two men of such stature. More than 200 hours' flying has been completed since January last year, and a large number of pilots have flown the aircraft. Flutter tests, using the RAE "bonker" system for the first time in North America, have already cleared the CL-41 for speeds of M0.75 (design limit, M0.8). The "bonker" charges ran out at this point, but no untoward effects were found and there is no reason to suppose that the full Mach limit will not be satisfactorily reached. Almost all the wide range of spinning trials are complete and excellent low-speed handling has been proved. Serviceability and accessibility are good and the prototype airframe looks remarkably sound after its tough flight-test and evaluation programme. Honeycomb stiffening is extensively used in the ailerons, elevator and neighbouring structure; and plastics have been employed, notably in the intake ducts. The fuselage is based on two longitudinal keels which provide belly-landing protection. Fuel has been concentrated in a five-cell cluster in the fuselage, thus avoiding fuel-management problems and any c.g. effects on handling or spinning characteristics. Hydraulic power operates undercarriage, flaps and airbrakes, but the flying controls are purely manual, in the interests of simplicity. Spring-tabs, geared tabs and trimming tabs on the ailerons will, in production, be replaced by a finalized combination of spring and trimming tabs. Airbrake shape will also be modified to provide roughly 100 per cent increase in effectiveness. The slotted flaps are very efficient.

Last week I flew the CL-41 with Ian MacTavish from Frankfurt Rhein-Main, just after the aircraft had been reassembled following air-freighting from Montreal by Lufthansa. Air-space for any sort of "local" flying is virtually unobtainable in that area, and ample fuel reserves have to be allowed for eventual holding before one is allowed to re-enter the circuit. Our flight was therefore somewhat limited, but I was able to fly the CL-41 by myself throughout, and to make three circuits in amongst the Connies and Convairs landing simultaneously on the two parallel runways.

I must admit that my impressions are somewhat influenced by the sheer joy of flying a jet again, and also of handling something designed to the much more stringent military handling requirements rather than for the over-forgiving executive clientele. The CL-41 has a spacious cockpit in which pilot and instructor will not rub elbows. The panel/windscreen compromise has been chosen to provide a large panel placed well above the control column, leaving a relatively shallow screen. Most controls, including throttles, toe-brakes and flap lever—but not undercarriage control and indicator—are duplicated. Starting, air-conditioning, electrical and radio controls are disposed on a central console. The CL-41 is pressurized so that training flights up to the ceiling of above 40,000ft can be prolonged in comfort. The two Weber ejection seats are relatively "basic" devices, with a simple lanyard connection between seat-harness opener and parachute barostat to get the pilot clear of the unstabilized seat 4sec after ejection. The seats will operate at down to about 200ft: runway-level capability is hardly necessary for an aircraft which unsticks very happily at below 80kt.

A six-instrument blind-flying panel, including a very useful RMI-type gyro compass, is provided in front of each pilot, and there are engine instruments, a warning panel, and temporary fire-extinguisher panel in the centre. Canopy and undercarriage controls are on the left. The straight stick does not obscure any of the instruments, and there is plenty of room for the full aileron throw without striking the knees. Pedal-reach is adjustable. Differential braking can be used for steering, but

"Flight" photograph

The wide, roomy cockpit has a central console for radio, electrics and air-conditioning and instructor's throttle and flap lever. The bank of warning indicators is in the centre with the engine instruments. Background colour is pale grey

CANADAIR CL-41
in the Air . . .

The CL-41 in the wooded maintenance area at Frankfurt airport. Note the clamshell canopy and high-set tailplane

normally a button is pressed on the stick to activate hydraulic nosewheel steering after the wheel has been aligned with the steering pawls.

Starting is quite automatic and extremely simple, and the engine control makes mishandling impossible. A burst of power started us forward and I engaged nosewheel steering and coasted down the long taxiway at idling power. Take-off flap was set, stick-top trim button held forward until a light showed elevator trim neutral, and tab position showed aileron trim neutral. Fuel contents were 1,500lb, to give this instrumented prototype a representative production weight.

For take-off I pushed the throttle hard forward and kept nosewheel steering engaged. After a pause the engine wound up and pushed us off down the runway. At about 50kt I released nosewheel steering and used the rudder, raised the nosewheel slightly at 70kt and pulled off at 80kt. Undercarriage retraction provided no trim change, the flaps gave a slight sink and we settled to climb at about 190kt and something over 2,000ft/min, homing on Nierstein NDB, near Worms.

First impression was of great smoothness, combined with a pleasant elevator and very crisp ailerons. Ian MacTavish had achieved an excellent combination of spring-tab lightness without the unpleasant springiness which these controls often have. For fast rolls at above 200kt the ailerons were a trifle heavy for the purist, but probably right for inexperienced pupils. Rudder, when used for deliberate yawing, was heavy and rather soggy. After letting the rudder go suddenly, at low speeds, the resulting oscillation continued for rather a long time. At speeds above 90kt, fast rolls into steep turns and rapid changes of direction could be made without any use of rudder, but below 90kt light rudder was necessary to keep the slip ball centred. Elevator forces during 2g steep turns appeared appropriate and comfortable. I particularly liked the CL-41's combination of crisp manœuvrability with willingness to fly hands-off.

Elevator trim was sensitive at the 80-per-cent-power cruising speed of 220kt at about 6,000ft, but not difficult to set after a little practice. At this speed, the airbrakes produced a firm nose-up trim change, and moderate drag with slight vibration. At lower speeds, particularly during approach, only the nose-up trim change remained, without any perceptible drag. As already noted, airbrake effectiveness is to be greatly increased in production aircraft.

With the aircraft clean I throttled right back and waited as the speed slowly reduced at constant height. Below 100kt the angle of attack increased considerably and a sharp, completely unmistakable vibration was followed almost immediately by a progressive wing-drop which developed into a spiral dive. The stick had just reached its back-stop. The stall was full-blown, but not rough, and the CL-41 recovered immediately back-pressure was released. I pulled out into level flight without applying power after losing 500ft. There was no tendency to stall again. In steep turns at about 150kt the stall was announced by the same pronounced vibration and a wing-drop, but recovery was again instantaneous when back-pressure was released.

I next slowed down and lowered gear and take-off flap at 175kt. Gear caused no trim change, but flap pulled the nose well down and a good pull on the trim button was needed. Full flap, lowered at 140kt, caused further nose-down trim change, but all could be fully cancelled out, power-off, at 95kt. I pulled back to the stall, which came, again with the stick just fully back, at about 70kt. Warning, wing-drop and recovery were the same.

CANADAIR CL-41A

(One Pratt & Whitney JT12 derated to 2,570lb thrust)
Span, 36ft 4in; length, 32ft; usable fuel, 1,900lb; gross weight, 7,200lb; limit load factor, 7.33g to −3.0g.

Performance: Maximum sea-level speed, 387kt; max speed at 30,000ft, 421kt; limit dive speed, 500kt; limit Mach number, 0.8; stalling speed, 68kt; service ceiling, 44,600ft; sea-level climb, 3,650ft/min; time to 20,000ft, 7.2min; take-off to 50ft, 2,230ft; landing distance from 50ft, 1,570ft.

We now headed for Frankfurt with fuel for possible extended holding. Being cleared straight in we decided on a roller landing, lowered gear, take-off flap and airbrakes downwind and settled at 125kt. I made a normal curved approach, applied full flap, slowed progressively to 95kt over the hedge and found no difficulty in wiping the main wheels onto the runway in traditional jet fashion. Holding the nose up I reduced to take-off flap, closed airbrakes and banged the throttle open. The nosewheel finally settled onto the runway just before the whoosh of full power sent us immediately into the air again for a normal take-off without any trim change. With everything out and down, the CL-41 climbs at 500ft/min at 110kt, but the angle of climb increases well as things come up and in. A curved climb put us back onto the downwind leg at 170kt and I went through another touch-and-go circuit before making the final landing between a Connie and a Convair.

During my limited flight I felt that the CL-41 rudder was heavy and rather weak, but in jet aircraft rudder function is rather specialized. The windscreen arch badly obstructed view of the runway at the end of a normal curved approach, but the arch thickness will be greatly reduced in production aircraft. More effective airbrakes will assist in steepening the approach, which is a trifle shallow at present. Otherwise the CL-41 was smooth and easy to fly and should really give pupils very little trouble and no pitfalls.

"Flight" photograph

Rear view of the CL-41 with airbrakes open during final pre-flight checks after assembly. The Boeing 707 belongs to Lufthansa, whose maintenance base Canadair use

459

LIVES SAVED TO DATE BY MARTIN-BAKER EJECTION SEATS

M-B A

TOP FLIGHT OPPORTUNITIES

English Electric are leading the rapid expansion and development now taking place in the Aircraft Equipment Industry. Now they have senior vacancies which can provide the satisfaction and excitement that can only come from working on new ideas.

These positions hold great prospects for advancement in a branch of engineering that calls for higher than average ability and the salaries that go with them are in keeping with the jobs themselves. The Division is equipped with all the latest laboratory and testing facilities.

The factory itself is only a quarter of an hour's drive from beautiful Yorkshire countryside. Houses are plentiful, prices are low. We will help with home finding and removal expenses, or provide a company-rented house.

The initial interviews can be held in London or at Division Headquarters.

Systems Design Engineer

Previous experience on the application of design of A.C. and D.C. power systems for aircraft is desirable. Candidates must have minimum qualification of H.N.C.

Transistor Applications Engineer

For work on the application of transistors to aircraft electrical power systems. Previous experience on related work is essential — such as semi-conductor devices, control systems, G.W. systems, either in industry or the services.

Senior Sales Engineer

Engineer with Aircraft background and 4-5 years commercial experience. To be based in the U.K. but with frequent visits to the Continent and occasional visits to other countries. A commercial foreign language is desirable, but not essential.

Junior Sales and Contracts Engineers, with preferably some commercial experience, are required to prepare estimates, contracts and to handle progress control at the Works.

AIRCRAFT EQUIPMENT DIVISION OF

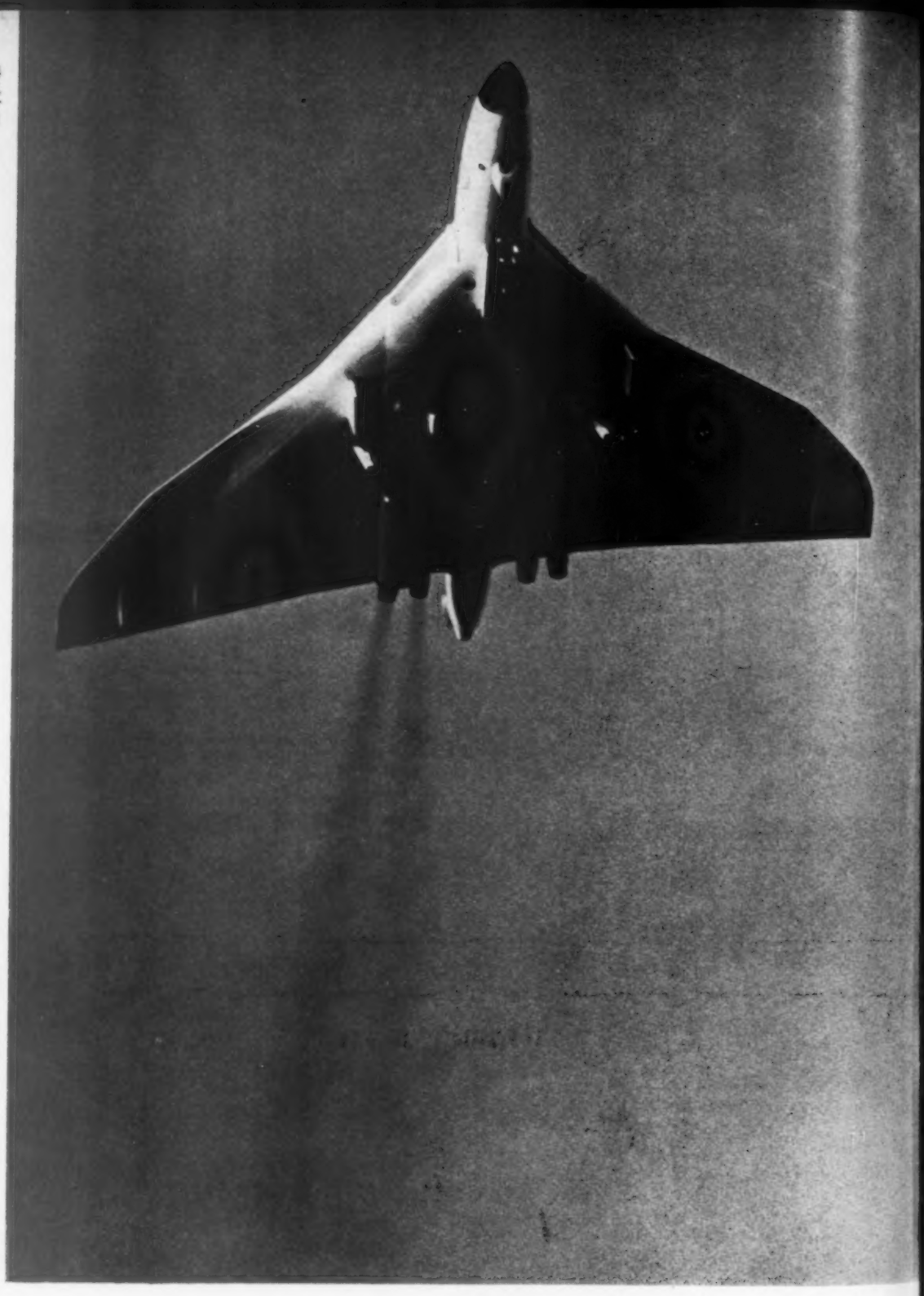
'ENGLISH ELECTRIC'

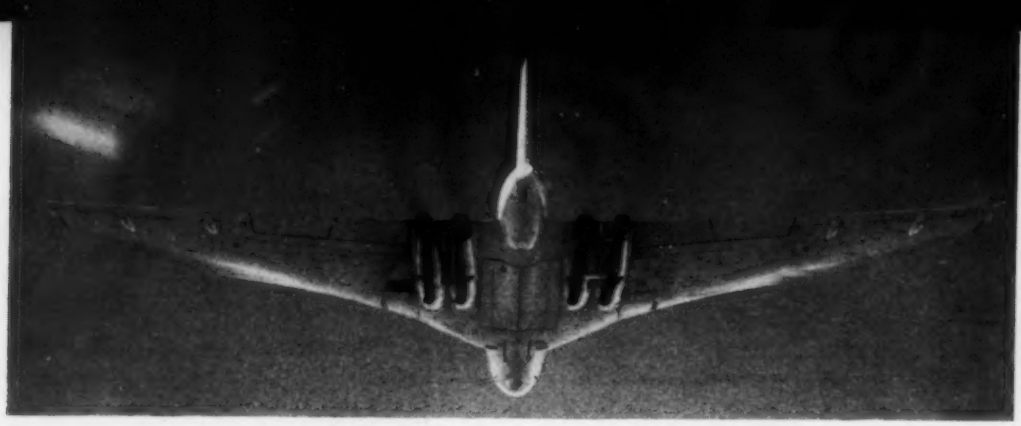
Please send your letter of application without delay to:

The Manager,
Aircraft Equipment Division,
English Electric Company Limited (G.P.S.)
English Electric House, Strand, London, W.C.2

READY FOR SHOW

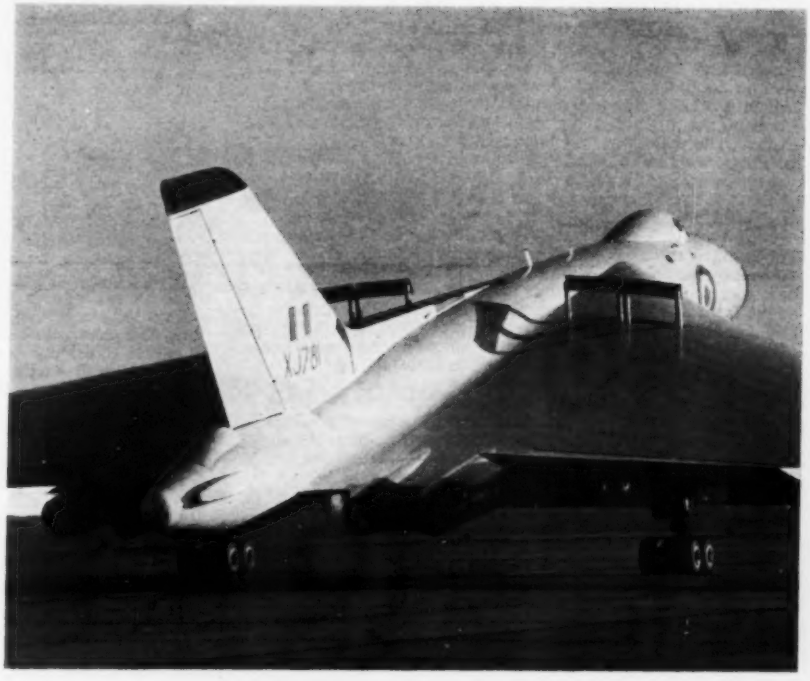
On a pre-Farnborough sortie the Beagle B.206 shows off its "Beagle-bronze" and white colour scheme

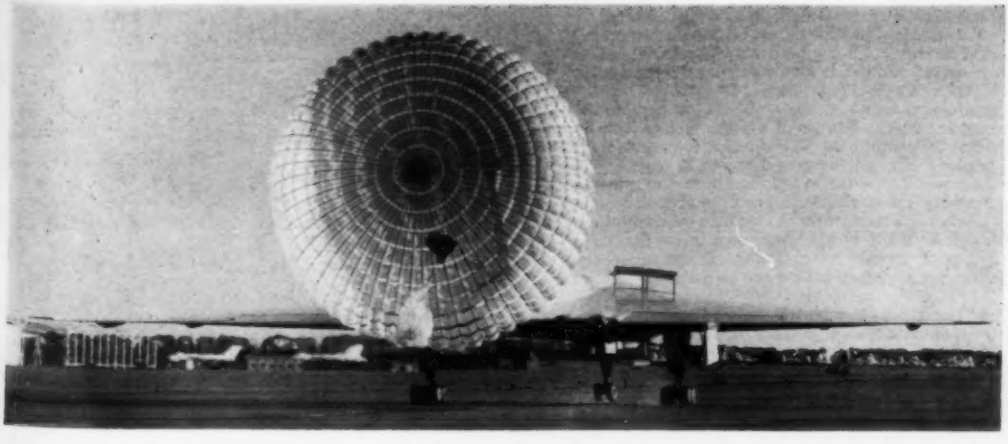




SCAMPTON'S VULCAN B.2s

SCAMPTON is one of the most famous Bomber Command stations: from here three Victoria Crosses were won on operations during the last war, from here Wg Cdr Guy Gibson led 617 Sqn Lancasters on the famous "dam busters" raid. Now Gibson's squadron is back at the station, re-formed and equipped with Avro Vulcan B.2s (four Bristol Siddeley Olympus turbojets of 17,000lb thrust), together with two other Vulcan B.2 squadrons, Nos 83 and 27. These studies are the work of *Flight* photographer Ian Macdonald during a recent visit to Scampton: his subjects, aircraft of Nos 83 and 27 Sqns. Photographic aircraft on the air-to-air sortie was a Canberra B.2 of 35 Sqn from Upwood flown by Sqn Ldr D. A. Dobbie, AFC, with Flt Lt H. G. Sealey as navigator; the "target" Vulcan was from 83 Sqn, flown by Sqn Ldr J. Sewell with Flt Lts J. F. Willis as co-pilot, C. W. Ward as nav/plotter, A. C. Clayphan as nav/radar and J. Bate as AEO. 83 Sqn is commanded by Wg Cdr R. J. Davenport, AFC, 27 by Wg Cdr V. N. Cramer and 617 by Wg Cdr L. G. A. Bastard, AFC. Station commander at Scampton is Gp Capt H. Burton, DSO, MBE; the Wing Commander Operations is Wg Cdr J. Garden, DFC.





VTOL Propulsion

A PAPER BY A ROLLS-ROYCE ENGINEER

THE September issue of the *Journal* of the Royal Aeronautical Society contains a paper, *Powerplants for Vertical Take-off Aircraft*, by Mr G. L. Wilde, AFRAeS, chief of preliminary design, Rolls-Royce Ltd, Derby. The following is an abbreviated version of his text, which forms a useful companion to other papers on the subject due to be read before the Anglo-American Aeronautical Conference next week.

Rolls-Royce studies, and experience with the Short SC.1, show that two types of VTOL aircraft can be developed in the immediate future. All the engineering problems of their powerplants can be solved using data which is now available or the results of current tests and research.

One of the types is a short/medium-range strike aircraft. It would cruise at high subsonic speed at sea level, carrying a military load equal to about 10 per cent of its gross weight. If supersonic performance at altitude were required this could be provided with reheat on the propulsion engine, but the aircraft weight would be greater. The other type, which could have either VTOL or STOL capability, would be a tactical transport of about 100,000lb take-off weight. It would carry a payload of 20,000 to 30,000lb for ranges of about 500 n.m., cruising at speeds of 300 to 400kt at heights up to 20,000ft.

Both types of VTOL strike aircraft rely on jet-lift engines. The cranked delta has four lift engines in the centre and a single efficient by-pass engine for propulsion. The second type has a wing of higher aspect ratio; the four lift engines are installed in pairs at the front and rear of a central weapons bay. Propulsion is by two turbojets in the wing roots; jet deflectors could give additional lift during take-off. The aircraft are stabilized during the hover and transition by bleed-air jets regulated by an autostabilizer.

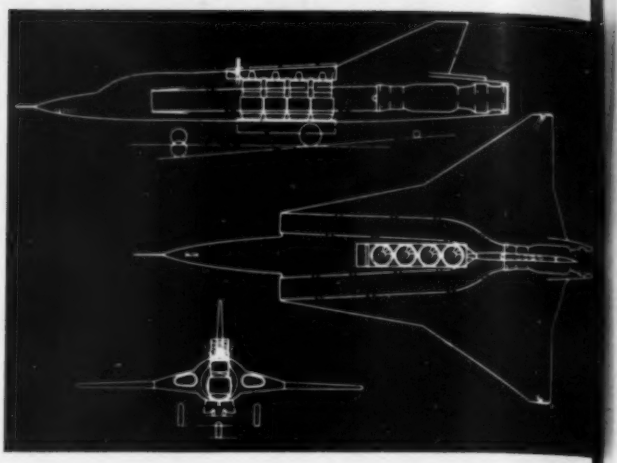
The cranked-delta is really a refinement of the SC.1 design, with lighter lift engines and a much more efficient propulsion engine. Although the second configuration is new, the layout presents no great difficulties. The pitching moment resulting from an engine failure will be greater than with the cranked-delta, and the aircraft will thus need a greater installed lift-thrust/weight ratio. The propulsion engines will be lighter than the by-pass engine of the other aircraft, but this will be offset by their higher fuel consumption.

It is often claimed that there will be a big saving in installed thrust if aircraft are designed for STOL rather than VTOL performance. This depends on the definition of STOL adopted. If it is taken to mean that the aircraft must reach a height of 50ft in a horizontal distance of 500ft, the thrust/weight ratio needed is 1.05. For STOL performance of this type it is necessary to deflect the thrust during take-off at low forward speed, when the aircraft aerodynamic controls will be inadequate. It is much better to design the aircraft from the start for VTOL operation, when a thrust/weight ratio of 1.2 is necessary. Installed thrust is not a great deal more than for the STOL, and if the aircraft is designed at the outset for VTOL its take-off and landing will be safer.

This does not mean, of course, that such an aircraft is limited to VTOL. If a strip is available, the VTOL can roll forward at up to, say, 30kt before opening up its lift engines; this will prevent debris ingestion. If no prepared ground is available, the STOL cannot operate, but the VTOL can take-off vertically.

If a definite requirement is stated for an STOL strike aircraft, a choice must be made between the use of a single engine with jet deflection, or a composite powerplant; in both cases a thrust/weight ratio of 1.05 is needed. If a single-engined layout is chosen, the powerplant will have too high a thrust for the cruise and must be designed with a medium pressure ratio to keep the specific weight low and with a high by-pass ratio to reduce consumption. The engine must be throttled to about 12 per cent thrust for cruise at M0.45, giving a poor specific consumption. If the composite powerplant is chosen, both types of engine can be designed without compromise.

Aircraft of these two types have been compared when both are designed to meet the same low-level strike role. The aircraft with composite powerplant will be much smaller for any given mission; and if the composite type has a by-pass propulsion engine, giving a good specific consumption, the single-engined aircraft will have a take-off weight more than double.

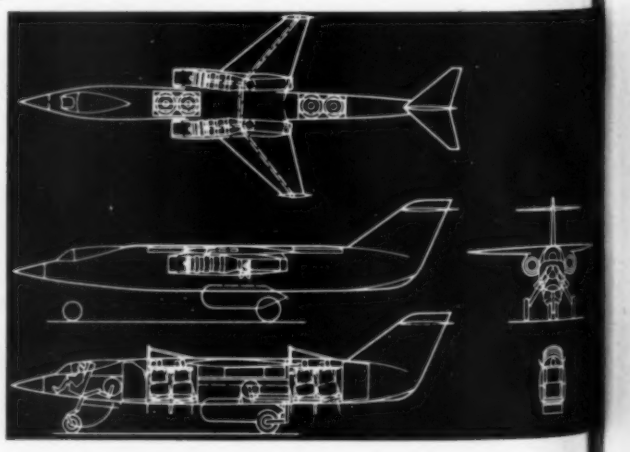


Tactical strike aircraft of delta configuration, with four 6,000lb lift turbojets and a single 11,000lb by-pass propulsion engine. The latter is not provided with jet deflection, but can be equipped with reheat

One multiple-engine approach is to provide all the lift thrust by lightweight booster or lift engines. Although this has a greater installed thrust and engine weight, it does not require jet deflectors, which are likely to be heavy and bulky; and it avoids the design problem of placing the propulsion engines so that their deflected thrust line passes close to the c.g. With both composite types the lift-engine thrust can be tilted by up to $\pm 30°$ from the vertical with only small weight penalties; in this way a large horizontal thrust component can be provided to assist acceleration or deceleration.

In estimating weight for the low-level strike mission a delta planform of low aspect ratio was chosen. High-lift devices were omitted, and a lightweight undercarriage was assumed. This led to the assumption that a structure weight of 18-20 per cent was possible, compared with 28-30 per cent for the STOL. Compared with the STOL aircraft a 50 per cent increase in propulsive thrust/weight ratio has been assumed. This is because it is necessary to maintain a high "g" capability in a steady level turn at high subsonic speed.

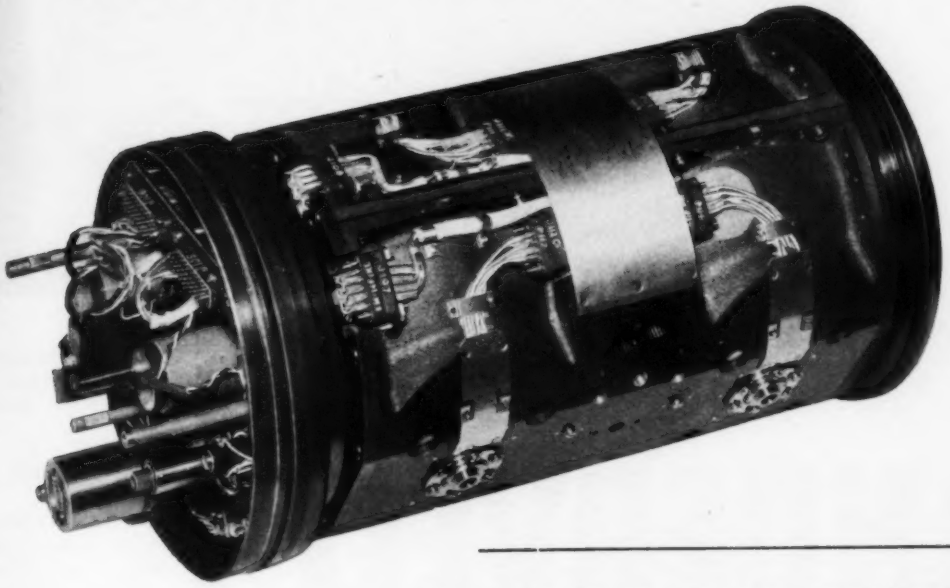
The conclusion from these Rolls-Royce studies is that sufficient booster or lift thrust can be installed to achieve vertical take-off and landing without the need for deflection of the propulsive thrust, and that a VTOL aircraft of this type need only be very little heavier than an STOL aircraft with a composite powerplant which has been designed for the same mission.



Tactical strike aircraft of swept-wing configuration, with four lift engines and two propulsion engines with jet deflection

SPERRY

TWIN-GYRO PLATFORM



The Sperry "Twin-gyro" Platform represents the most advanced *developed* platform reference for manned aircraft applications utilising non-floated gyros.

Using two directional gyroscopes with "Rotorace" ® bearings mounted in a coupled gimbal system of novel design, this equipment provides a fully manoeuvrable heading and attitude reference with "Inertial" quality performance.

CHECK THESE FEATURES-

✔	***Proved performance***
✔	***Readiness time***
✔	***Reliability***
✔	***Size and weight***
✔	***Cost***
✔	***Availability***
✔	***Maintenance and overhaul***
✔	***Technical support***
✔	***System "growth" potential***

SPERRY GYROSCOPE COMPANY LIMITED

Great West Road, Brentford, Middlesex

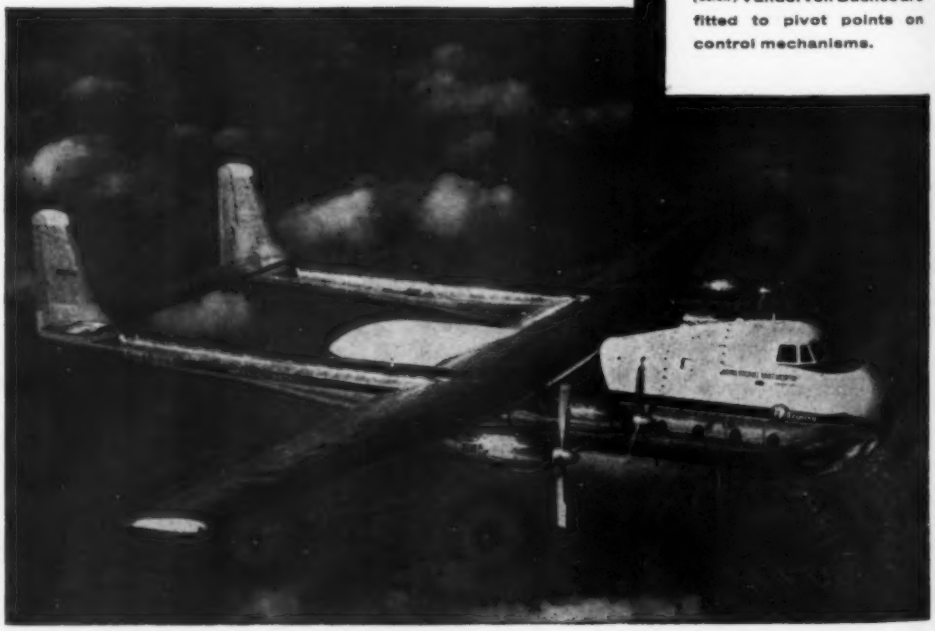
Telephone: ISLeworth 1241. Telex 23800

Vickers Vanguard
(above) Vandervell Bushes are fitted to flap mechanisms.

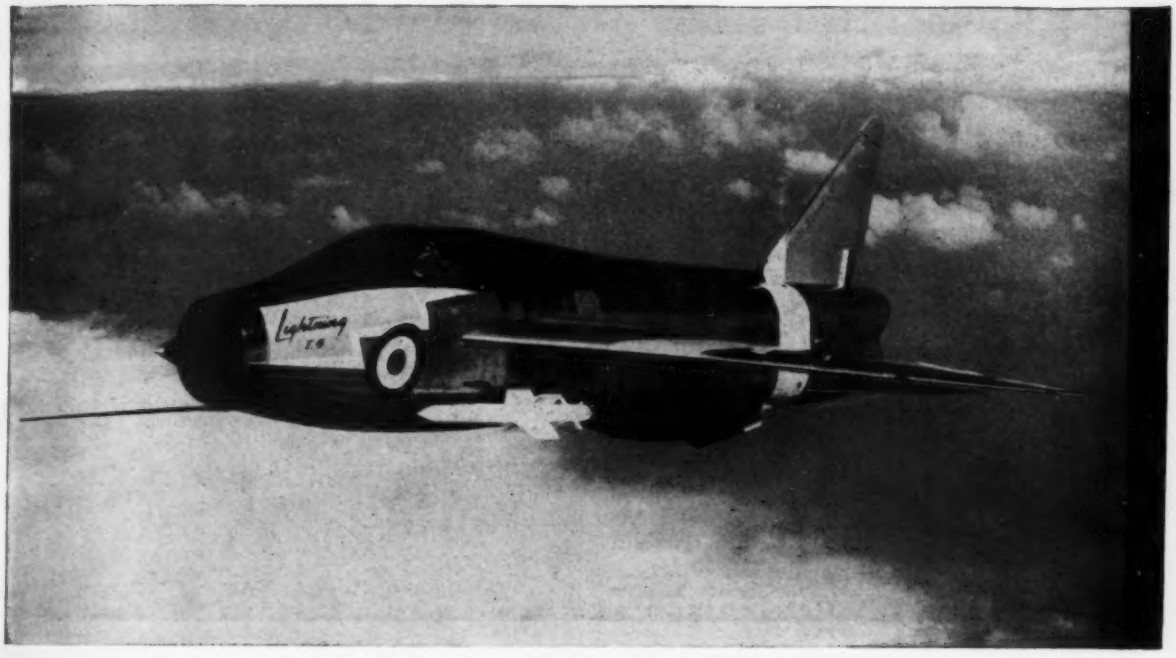
VANDERVELL
BUSHES

English Electric Lightning Supersonic Aircraft
(right) Vandervell Bushes are installed in actuating mechanisms for power assisted controls operating ailerons and tail plane.

Armstrong Whitworth Argosy Type AW 650 Freight-Liner
(below) Vandervell Bushes are fitted to pivot points on control mechanisms.



used in the aircraft industry



VANDERVELL

REGD. TRADE MARK

The largest producers of bearings and bushes in Europe

VANDERVELL PRODUCTS LTD · WESTERN AVENUE · ACTON · LONDON · W.3
VANDERVELL PRODUCTS (CANADA) LTD · TORONTO · CANADA

Smee's V152

NEW AND INTEGRATED BREATHING SYSTEMS FOR MILITARY AIRCRAFT

Protection at Altitude and Safety in Emergency

NORMALAIR oxygen breathing equipment is fitted to all front line R.A.F. Aircraft and to those of seventeen Air Forces all over the World.

The new Normalair seat mounted oxygen regulator system, integrated with the Normalair Emergency Oxygen Regulator, represents advanced design to improve performance and to simplify operation, installation and maintenance in high performance military aircraft. The Emergency Regulator not only provides for oxygen breathing on aircraft evacuation – it can also be used to regulate the oxygen supply to the crew members in cases of cockpit contamination or other flight emergencies.

NORMALAIR

YEOVIL ENGLAND

EUROPE'S LARGEST AND MOST EXPERIENCED PRODUCERS OF AIRCRAFT CABIN AIR CONDITIONING SYSTEMS AND COMPONENTS

NORMALAIR (CANADA) LTD., TORONTO NORMALAIR (AUSTRALIA) PTY. LTD., ESSENDEN, VICTORIA

VTOL PROPULSION...

Tactical Transport

Although by no means an ideal solution, a practical step towards the large VTOL transport would be an aircraft of the type illustrated. One has jet lift engines; the other has lift fans, with thrust deflectors on the propulsion engines. An arrangement of this type offers little scope for reduction of structure weight, and VTOL capability brings with it severe range and payload penalties.

With such an aircraft it is unlikely to be practical to deflect all the thrust. For VTOL operation, at 2,000ft at ISA + 20°C, the lift-thrust/weight ratio should be 1.4 to 1.45.

Lift-engine Experience

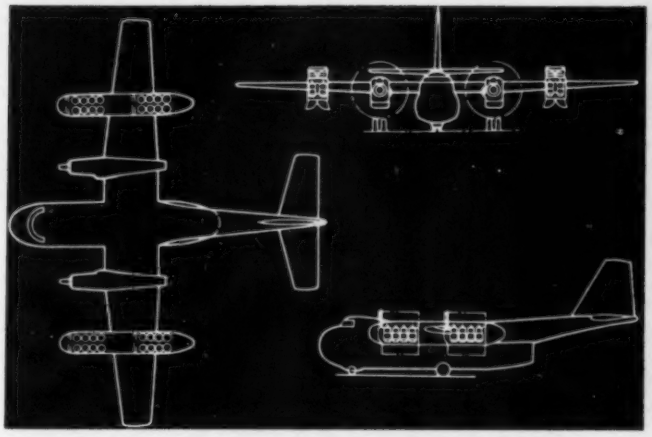
Original studies were based on the assumption that lift engines would run for 3min at full power during each sortie. But the SC.1 takes 30sec from lift-off to wing-borne flight. Fuel consumption is thus less important than low weight.

The ratio of lift-thrust to weight depends on configuration and operational environment. The size or number of lift engines is decided by matching the take-off rating to the hottest and highest operational conditions. Lift-engine overhaul life might be about 800hr, equivalent to 16,000 airframe hours. Intensive cycling tests with an RB.108 will give a sound basis for predicting the service life of lift engines. An emergency rating can be offered for use only if one engine in a group were to fail.

A lift engine must have good starting characteristics, low idling speed, fast acceleration and a rapid thrust response to a sudden change in fuel flow. The RB.108 has the rapid thrust response to throttle movement of about 0.1sec; this factor is particularly important if aircraft pitch and roll control is by differential throttling of lift engines as it might be on a VTOL transport.

More than 4,500hr of test-bed and flight experience have been gained with the RB.108. Designed in 1954, it gives a thrust of 2,200lb with a 10 per cent bleed, or 2,500lb without bleed.

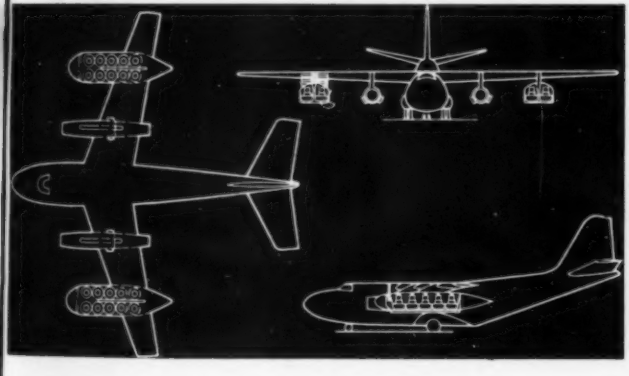
It is now possible to design a much lighter, cheaper and more simple engine. By using the latest materials and manufacturing techniques, the cost per unit thrust can be reduced to less than half that of a propulsion engine of the same thrust. Simplicity is one reason for this. The lift engine has roughly one-quarter as many components as a Conway; there are no auxiliary drives and only very simple starting and fuel systems. It takes 22 man-hours to build and strip a lift engine, compared with several hundred for the Conway. A group of six lift engines with systems is no more complex than a single Conway pod.



Tactical freight aircraft with 32 turbojet lift engines of 4,750lb each and two Tyne turboprops for propulsion

Lift turbojets of 3,000 to 5,000lb appear the most suitable for small military VTOL aircraft. For large freight aircraft turbofans of 8,000 to 12,000lb seem preferable, largely because they produce less noise; but they have a lower thrust-response rate, which affects aircraft control. They also suffer from a relatively high thrust penalty if they are designed to supply high-pressure control jets. Both turbojet and turbofan lift engines have been built and tested by Rolls-Royce.

Tactical freight aircraft with 20 turbofan lift engines of 7,500lb each and two 15,000lb turbojets for propulsion with jet deflection



Composite powerplant	VTOL		STOL
	Without propulsion-engine deflection	With propulsion-engine deflection	All engines with deflection
Propulsion engine type	By-pass	By-pass	By-pass
Pressure ratio	18	18	18
By-pass ratio	0.95	0.95	0.95
Specific weight (engine only)	0.20	0.20	0.20
Static thrust/aircraft weight	0.75 (no deflection loss)	0.69 (8% deflection loss)	0.46 (8% deflection loss)
Booster engine	Vertical turbojets	Vertical turbojets	Turbojets
Assumed booster specific weight	0.06	0.06	0.06
Booster thrust/aicraft weight	1.20	0.51	0.59
Total installed thrust/weight	1.95	1.20	1.05
Structure weight (%)	17.9	18.1	30.3
Powerplant weight (%)	35	30.6	25.7
Fuel (%)	28.6	28.6	24.3
Military load (%)	18.5	22.7	19.7
Take-off weight ratio to meet mission requirement of 400-600 n.m. at sea-level	1.06	0.865	1.0

FIRST TRANS-AMERICAN FLIGHT

THE golden jubilee year of the first coast-to-coast flight across the American continent—by Calbraith Rodgers in the autumn of 1911—is to be celebrated by ceremonies at the Smithsonian Institution, Washington DC.

Piloting a Wright EX-type biplane, named *Vin Fiz* after a soft drink of the day, Rodgers flew 4,321 miles from Sheepshead Bay, Long Island, to Long Beach, California, in 84 days (September 17-December 10), making 69 landings, some of which were extremely damaging: it is said that he repaired his machine so many times that the only original parts to survive were a rudder and one strut. *Vin Fiz*, recently restored to its original condition, is now one of the attractions of the Smithsonian's National Air Museum.

He was born at Pittsburgh, Pa, in 1879, a great-grandson of Commodore Matthew Calbraith Perry, who introduced Western civilization to Japan. At the Wright brothers' flying school near Dayton, Ohio, in 1911, he soloed after 90 minutes of instruction; and two months later, during a nine-day flying meeting held at Chicago, he won the award for the most time in the air, flying every day and totalling over 27 hours.

In those early days, prizes were offered by newspapers for city-to-city flights. The Hearst newspapers topped them all with a $50,000 prize for the first flight from coast to coast. Rodgers and a number of others entered this competition. He was sponsored by the Armour Company of Chicago, then (as now) meat packers, but also interested at that time in marketing Vin Fiz. Rodgers received $5 for every mile flown with the name of this drink lettered on his machine.

Rodgers's Wright biplane had a wing span of 32ft, length of 21ft and weighed 903lb with pilot. It was powered by a Wright four-cylinder water-cooled engine of 35 h.p., driving two pusher propellers and with fuel for three-and-a-half hours. Top speed was 55 m.p.h.

F.C.L.

ROCKFORD FLY-IN

BY BOB WHITTIER

This tiny delta from Michigan flew, and flew well

ONE can safely use the patented Hollywood superlatives *colossal, magnificent* and *stupendous* to describe the eighth annual International Fly-in of the Experimental Aircraft Association held last month at Rockford, Ill. For nobody who was there will deny that they appropriately and honestly describe the event. It was truly an aviation enthusiast's dream!

Generally good weather, an excellent turn-out of airplanes and people and a most interesting collection of aeronautical equipment went to make a show that will long be remembered. More than one happy visitor was heard to remark that there was so much to see and so many things going on that he was reminded of the atmosphere of the big national aviation meets of the 1930s.

Approximately 95 amateur-built and antique airplanes and several sailplanes turned out, as well as some hundreds of visiting factory-built machines. The latter occupied tie-down rows which stretched so far around the edge of the field that only a keen hiker would consider inspecting them all. The homebuilts had their separate tie-down area, which at the height of the show numbered several rows of a dozen ships each. They came from all over the United States and a few showed up from Canada. Such far-away points as New York, Florida, Georgia, Oklahoma, Texas and California were represented, which shows what these mites can do in the line of covering territory. Chaps would put a toilet kit on the floorboards, tuck a sleeping bag into their laps, shove some aeronautical charts between the tubing and fabric at the cockpit side, and head off for a flight of 500, 1,000 or more miles as a matter of course. This EAA outfit is indeed giving birth to a modern generation of sky gypsies!

As in past years, a strict no-aerobatics rule was in effect for the homebuilts, in the interest of preserving a spotless fly-in safety record. This limits flight activity more or less to fly-pasts, followed by zooms, so to pep things up a little the EAA planners had on hand some professional exhibition pilots. Each evening, after the day's heat and turbulence had died down, Duane Cole, operator of an Illinois airport, put on an excellent acrobatic show in his much-modified Taylorcraft. A single seat is mounted on the centreline of the two-seat, side-by-side fuselage, and furnished with a stick control. The landing gear has no shock-absorbers and the cabin interior is stripped of all trim in the interest of low weight. Wings are appreciably shortened, with much closer rib spacing, and the 90 h.p. Continental engine is modified for inverted flight.

In this rig Duane lazed his way through intricate loops and rolls with the smoothness and grace of a ballet dancer, topping it all off with snap rolls done while ascending vertically, followed by some slightly scary fall-outs from the inverted-and-stalled position. Added acrobatic thrills were provided by Bill Adams and his wife with their superb 450 h.p. Stearman biplane. Mrs Adams straps herself to an upright strut atop the centre section, and Bill puts the whole rig through a series of loops, rolls and inverted passes over the field that leave thousands of wives *entirely* content with their earthbound husbands.

Also on hand to add to the fun was a 1929 Ford Trimotor, a veteran of Mexico and South America and reputedly one of PanAm's original ships. This noisemaker was kept very busy indeed, taking all comers for rides around Rockford in true old-time barnstormer fashion. It became about the most familiar sight in the sky, roaring in and out of the field importantly and cruising around on the horizon like nothing so much as a huge Cub.

Aviation veteran Arthur Hartman soloed a hot-air balloon in September 1903 and has had his hand in the flying-machine business ever since. A few seasons ago he grew tired of the idleness of retirement, so hunted down and rebuilt an-honest-to-gosh Curtiss JN4-D of 1918 vintage. This year, at the age of 71, he showed up with the craft on a trailer. Each day the venerable craft and its pilot made exhibition flights over the field, to the mingled delight and wonderment of all present. The Jenny's very long fuselage seems to account for its strange actions in the air, each slight movement on the stick causing the tail to go up or down quite appreciably to get the desired alteration in angle of attack, with the end result that the ship drifts along in an undulating manner reminiscent of a sea serpent. One sportsman pilot, Jerry Waldron, showed up with his North American P-51, and gave rides to many of the fellows, so there you had the sky filled with Jennies and Fords and Mustangs and innumerable small craft of all shapes and sizes. If a person had stumbled upon the meeting without knowing what was afoot he might well have feared he was having hallucinations.

To clutter up the air still further with interesting conveyances, several sailplanes were on hand to show what that kind of sporting aircraft can do; the Wisconsin Sky Divers put on a demonstration of jumping, and Igor Benson demonstrated his virtuosity at handling his little Gyro-Copter machine (which some rude people call a Kennedycopter because in the air it looks so much like a flying rocking-chair); the United States Air Force sent a B-52 around to

Left, Turner's handsome, original low-wing design in high-gloss red-and-white; top of fuselage flat; streamlined canopy sliding straight back on simple guides; "all-flying" tail. Left, below, typical of small, sporty biplanes was this example of the Mong design. Below, neat yellow Pietenpol of 1933 design built by a Mr Hallingstad of Wisconsin, who reported himself delighted with its fly-for-fun capabilities

JET CLEARANCE WITH ONE RADAR

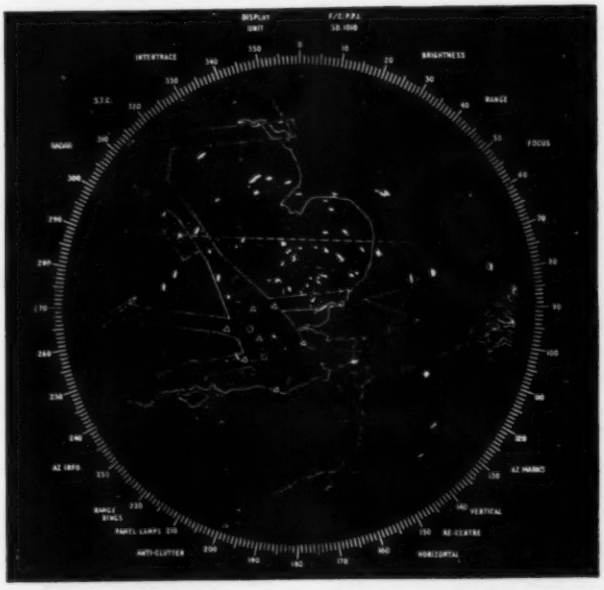
FROM TAKE OFF TO 150 MILES PLUS

WHATEVER THE TERRAIN–WHATEVER THE WEATHER

S.264A THE MOST ADVANCED AIR TRAFFIC CONTROL RADAR IN THE WORLD

Marconi 50 cm. Radar is immune from weather effects without polarisers and has a fully coherent crystal controlled MTI system.

30 MARCONI *50* CM. RADARS HAVE BEEN ORDERED OR INSTALLED IN THE U.K., EUROPE, ASIA, AFRICA AND AUSTRALASIA.



MARCONI

COMPLETE CIVIL, MILITARY AND NAVAL RADAR INSTALLATIONS

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND

2 important new features for

Mk 20 Refuelling Pack

* **COLLAPSIBLE DROGUE**
—folds when fuel hose is retracted

* **MORE COMPACT POD**
—which houses folded drogue

These major modifications to the Mk. 20 Refuelling Pack — the unit that rapidly converts a fighter into an aerial tanker — result in a neater, more streamlined appearance. The pack supplies fuel at a rate of 150 gallons per minute and at a pressure of 50 p.s.i. It meets the operating conditions of service requirements for fighters. The pack is arranged to accept fuel from the carrying aircraft to supplement the supply required by the receiver aircraft. Fuel can also be used from this pack to augment the carrying aircraft's fuel supply should refuelling not take place. Jettisoning is provided for emergency conditions. Illustrations show the new Mk.20 Refuelling Pack undergoing evaluation trials on a Canberra, and also the pack during ground testing at Tarrant Rushton. Note photo showing drogue folded and stowed.

TA 5026

Flight Refuelling Ltd.

Tarrant Rushton Airfield, Blandford, Dorset
Telephone: Blandford 501. Telegrams: Refuelling Blandford

Above, left and right, 71-year-old Art Hartman restored this 1918 Curtiss Jenny as a memorial to the people he had known in 58 years of aviation activity; even the propeller had names painted on it. Lower right, a half-scale, flyable Jenny attracted much admiration

ROCKFORD FLY-IN . . .

make a few low-level passes, and so, all-in-all, there was a real "Jennies to jets" pageant out at Rockford's big and beautiful airport.

Getting around to the amateur-builts, most seemed to have been assembled from stock plans, for there were numerous examples of the Baby Ace, Cougar, Tailwind, Stits Playboy, Mong biplane and others. The group as a whole seems to be quite competent on the construction side, but less strong in the field of engineering. Yet there were some interesting and quite admirable original design efforts on hand, ranging from an all-metal delta-wing job which flew very well indeed, and an as-yet-to-be tested twin-boom, outrigger-landing-gear pusher, to some pretty little biplanes and snappy low-wing monoplanes. N115ET, built by Mr Turner of Fort Worth, Texas, was notable not only for its excellent finish but for the fact that it utilizes commercial-grade, inexpensive Douglas fir for many structural members. Turner is an FAA employee, but he found that when the time came for registration his position was of no avail in unsnarling an administrative foul-up, and he had to wait months to get into the air.

A pretty accurate half-size reproduction of the Curtiss JN4 was shown by F. A. Murray of Rockford. Powered by a Model A Ford engine, it is a masterpiece of workmanship and caught much attention when parked beside Hartman's real "Jenny." At the time of the Fly-in it was still in the taxi test stage, but next year we may see it aloft.

This year activity was concentrated in a smaller area by the adoption of two large tents near the aircraft park, saving much walking to and from hangars some hundreds of yards away. In one tent were the static displays, including a number of aircraft in various stages of construction; engines, parts and materials; and panel after panel of photographs depicting the activities of the many EAA chapters in various cities. Mr R. G. Huggins of Tulsa, Okla, has been actively developing Volkswagen conversion kits and had three live engines on display. Another firm from Oklahoma has been producing small stock and custom propellers, including models for the VW and the various drone engines used in Gyro-Copters, and had a companion display. Outside the tent, men gave demonstrations of Fiberglas-forming, low-temperature welding, a home-made Wankel engine, Gyro-Copters, and so on.

In a nearby tent there was a stage, speaker's stand and ample chairs, and here was held a series of forums on design, regulations and other matters. In the evenings, meetings were held to transact EAA business, conduct elections, make awards and have a little fun. Old aviation motion-pictures were shown, interesting lectures on design were given by men such as Dr Joseph Cornish of the University of Mississippi, and humorous aviation skits were put on. This year, a comely "Miss Sport Aviation" was on hand and added materially to the pleasure of receiving trophies. The old Ford Trimotor was kept busy long after dark, taking working people from Rockford for rides, and the racket of this old ship taking off periodically drowned-out the speakers. However, nobody could get sore at a Tin Goose, and speakers would resume after a suitable wait.

Of EAA as a whole, it can be reported that the membership has now grown to 11,000 strong, and the group has both respect and influence in aviation matters. Relations with the FAA are wholesome and constructive, and currently both groups are working out a set of new and mutually satisfactory regulations. A few bad accidents have marred the year, but the overall safety record is excellent. One crash, fatal to two, happened when a commercial pilot borrowed an amateur-built without authorization, took a total stranger aboard, and attempted aerobatics for which the small, swift plane was definitely not intended; he lost a wing. An airplane of proven design, passed as sound and airworthy by the FAA, lost a wing when terminal speed was exceeded in a dive to pull 3g for removal of the restriction against passenger carrying, and the builder lost his life.

On the other hand, the fly-in gave good reassurance that, on the whole, these small ships can be safe. The only mishap in several years happened when the wind shifted suddenly and made a 1926-model Waco 9 ground-loop, taking off the lower wings and landing gear. But then, that ship always was a ground-looper, with its high centre of gravity, narrow, flexible rubber-cord sprung landing gear, no brakes and full-swivel, non-locking tailskid. The homebuilts suffered not a scratch, and racked up an awe-inspiring operations record. Counting these, visitors' and local private ships and commercial flights, there were 2,230 aircraft movements on the first day of the meet, 2,533 on the second and 2,703 on the third. The last figure is believed to be a world record, and is all the more impressive by reason of the fact that 95 per cent of the movements took place between 9 a.m. and 8.15 p.m., and that 75 per cent of the planes carried no radio. Yet not a single traffic incident took place. As EAA President Paul Poberezny commented laconically, "Pretty good, I'd say, for us amateurs!"

With a total of 60 hours in his log-book, Arlo Schroeder of Kansas built and flew this very workmanlike "Little Toot"; its paint job duplicates that of the Curtiss P-6E Hawk of the 1930s. Right, they came in all sizes and shapes—a P-51 and a "Tin Goose" (Ford Trimotor) on the flight line

Straight and Level

HIGHLIGHTS of the SBAC Display this year (writes Dr J. Nit, Straight and Level's air expert) are again suspended from the roof of the exhibition hall and are switched on each night, usually when it gets dark.

Entirely new this year is the 290-decibel British Air Trumpet displayed on the **Thinx Electronics Ltd** stand. At one-minute intervals it blares: GREATEST BRITISH AIR SHOW ON EARTH.

Dominating the **Scruggs Aircraft Ltd** stand, which is defended by sandbags and electrified barbed wire, is an inflatable foam-rubber reproduction of a customer.

Attracting keen interest in the outside exhibition is **Gargantuan Grouponics Ltd's** working mock-up of a brochure factory, while long queues wait all day outside the **Ministry of Planes** enclosure to see the Costplus Film Unit's fascinating new documentary *Where The Money Goes.*

● Lord Brabazon is one of the treasured few in British aviation who stand up and say what they think without fear of offending the omnipotent Minister. Some of the things he has said on the subject of safety have, I am sure, made the Minister's hair stand on end.

If this were any other country I would have viewed with grave suspicion the Minister's recent decision to appoint Brab as chairman of the Air Safety Board. But it is an old British custom for rebels to be appointed administrators—provided the rebelliousness is sincere and responsible, as it is with Lord Brabazon.

* * *

The first thing that Brab must do in his new post is to assert the existence of the Air Safety Board. Never once has this body made a public utterance. (I can't even find a reference to it in my filing system, although that doesn't necessarily mean much.) Then he must try to cure the secrecy neurosis that afflicts our Ministry's safety people.

If I had to invent a motto for the furtherance of air safety, it would be this: Establish the causes of accidents, *publish* the causes of accidents. Establish and publish. The Ministry is second to none at establishing. But why does it bother to establish if it doesn't publish? In publishing the causes and circumstances of accidents—which is the only way of avoiding repetitions—the Ministry is woefully lacking. There have been 40 accidents in the last few years about which nothing has ever been published. Here is something which Lord Brabazon can now try to put right.

● From a Russian brochure on the Tu-104B issued at the recent Soviet exhibition in London: "*The TU-104B is a modified Tu-104—the world's first jet airliner to fly regularly on passenger air routes.*"

● Are you an airline operator having difficulties with the Ruritanian authorities about getting traffic rights to Strelsau? Jump the gun on your competitors, confuse your bankers, your creditors,

This is the cover of a new Hertz brochure. There are perhaps three explanations: (1) Hertz has a spy in the Air Transport Licensing Board; (2) It is part of a gigantic hoax (next week, lads, the fabulous Goon Show); (3) It's true. I asked a BEA spokesman whether (3) is the right explanation. He replied: "It's not true, I tell you. We're just good friends"

outwit the Air Transport Licensing Board and fool the Ministry simply by operating *in disguise*!

Flight Falsies Ltd offers an exciting new range of disguises that no smart airline can afford to be without today.

Transfers guaranteed not to peel off in Sahara sun or English rain offer a range of exciting new titles to evade tiresome international regulations. Change your name in seconds—to Air Atlantis, Bohemian International Airlines, SCAT (Serbo-Croatian Aero Transport), Lineas Aereas de Hispaniola SA (LAHSA), Mammoth Intercontinental Airlines (Potters Bar) Ltd—there are many others in the Flight Falsies range. Flight Falsies' confidential advisory service will help you select a title that will best achieve the desired corporate image. And remember—Flight Falsies personalized repainting service arranges to meet all flights!

Or how about Flight Falsies' latest idea—a long transparent window in the fuselage, like the one in the front of a London bus, showing the title under which you wish to operate! Titles can be varied simply by the pilot leaning out of the cockpit window and turning a handle, thus changing the titles as easily as any bus conductor. All enquiries treated in confidence.

● On an envelope from Eastern Air Lines appears the message: "*You would receive full benefit if 10 per cent US tax on domestic passenger transportation were repealed—adv of Eastern Air Lines Inc.*"

It is a broad-minded government that allows its postal authority to accept anti-government advertisements.

● I watched the recent ITV edition of *This Week* which featured Britain's independent airlines. When I first heard that this subject was going to be televised I was filled with dread. When one independent has a crash and another goes bankrupt within one week, the two events being utterly unrelated, the scope for getting things out of perspective is immense. Especially when you think that ITV hasn't even got an air correspondent.

* * *

But it turned out to be remarkably well done. The matter of safety was handled with great care; nothing got out of focus here. The question of stranded passengers was gone into; Mr Frederick Beezley of Falcon Airways didn't think it was wrong to take on so much business that passengers are delayed because pilots run out of hours—"safety comes first," he asserted. This was television at its most effective; questions that the viewer wants answered were asked, and the viewer left to draw his own conclusions from the answers.

The best point was made by a travel agent. It was so good that it ought to be recorded and played on my British Air Trumpet outside every travel agent's office throughout the length and breadth of the realm. The independent drakes will be separated from the ducks if the public always makes a point of asking travel agents the name of the operator who will fly them, and the proposed times of departure and arrival.

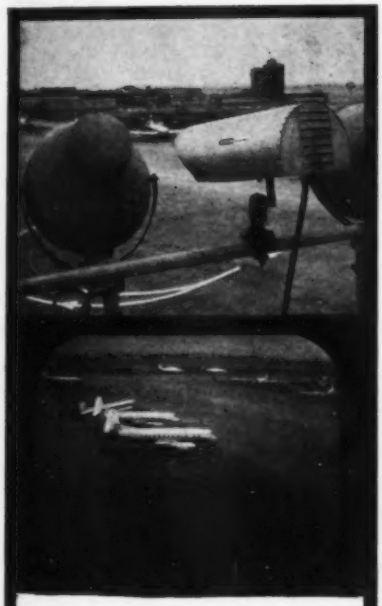
Flight Falsies Ltd at Work?

● "British European Airways it to open a Corset Jet service to Madeira on December 6."—*Sunday Telegraph.*

ROGER BACON

AIR TRAFFIC CONTROL
Television can present tabulated flight progress information instantaneously wherever it is required in an air traffic control centre.

TAKE A GOOD VIEW



APRON SURVEILLANCE
Television presents an all-round view of the complete parking area, eliminating the blind spots and enabling the marshalling supervisor to see the number and disposition of aircraft anywhere on the apron.

DATA TRANSMISSION FOR AIR TRAFFIC CONTROL

PASSENGER HANDLING INFORMATION

ARRIVAL/DEPARTURE INFORMATION

FLIGHT SCHEDULE INFORMATION

FLIGHT MOVEMENT INFORMATION

WIND TUNNEL OBSERVATION

MET. BRIEFING

DOCUMENT TRANSMISSION

TRAINING

FLIGHT TESTING

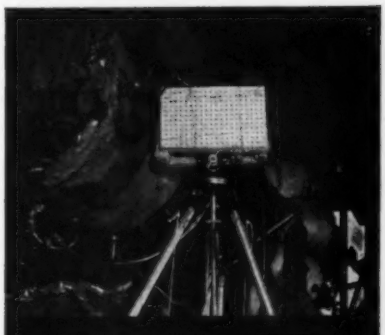
RUNWAY OBSERVATION

APRON SURVEILLANCE

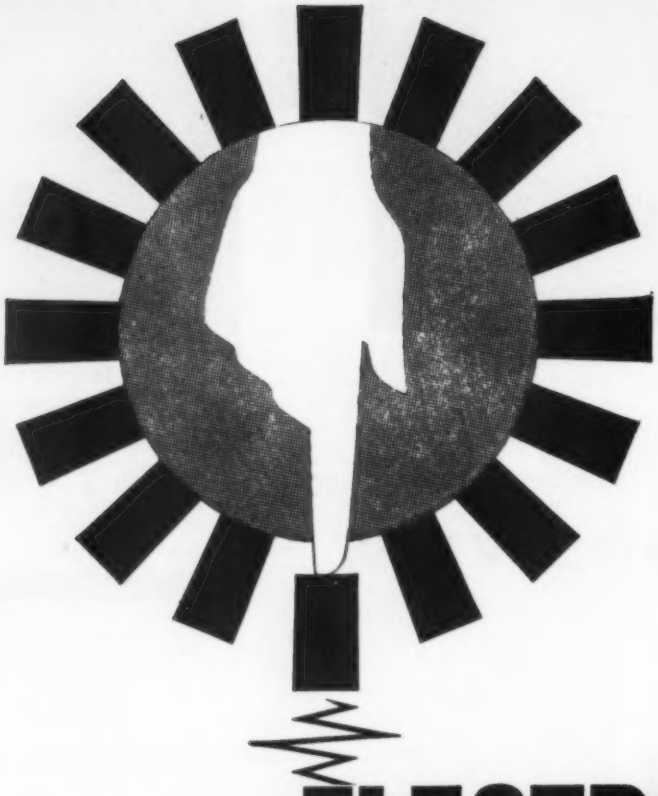
MARCONI

TELEVISION FOR AVIATION

Closed Circuit Television Division
MARCONI'S WIRELESS TELEGRAPH
COMPANY LIMITED
BASILDON, ESSEX, ENGLAND



RESEARCH
Observation of after burning in a gas turbine engine at a government research station. This is typical of the many research applications for which television is being used to-day.



ELECTRONIC COMPUTER EXHIBITION

AND THE ELECTRONIC DATA PROCESSING SYMPOSIUM

NATIONAL HALL OLYMPIA London

OCTOBER 3rd-12th 10·30am to 7pm

October 3rd only NOON - 7pm Saturday 10·30am to 4pm

Visitors to Olympia can see a working demonstration of some of the most up-to-date electronic computers and ancillary equipment in the world. Britain's leading manufacturers will display their latest equipment, and experts on the various stands will be ready to offer information and advice about electronic data-processing of every sort. Whatever the size and nature of *your* business, here is an exhibition you cannot afford to miss. If you cannot attend yourself, you should at least send an observer.

THE ELECTRONIC DATA PROCESSING SYMPOSIUM

During the Exhibition a three day symposium will be held. Executives, well versed in computer techniques, will come from a wide range of concerns—both State and private enterprises—to give registered delegates the benefit of their user knowledge and experience. All six sessions will be informal, and a highly useful exchange of ideas and information will result.

For further information contact Mrs. S. S. Elliott, M.B.E., 64 Cannon Street, London, E.C.4. Telephone: CENtral 7771/2.

SEE THE NEW GENERATION OF COMPUTERS AT WORK

AIR COMMERCE . . .

STAVANGER INQUIRY

ACCORDING to Col J. K. Christie, the chairman of the Norwegian commission of enquiry into the Cunard Eagle accident at Stavanger, the commander, Capt Philip Watts, had never been to Sola Airport Stavanger before. Col Christie said that it had not yet been established whether the second pilot had been there.

The commission's preliminary report, published on August 25 (and which drew from the Ministry of Aviation an expression of thanks for "the expeditious and painstaking manner in which the enquiry is being conducted") is summarized on this page.

This preliminary report does not touch on the subject of the commander's experience of the route; the information above was given by Col Christie at a news conference, in answer to a question. This aspect of the accident is obviously one that is being carefully examined by the Ministry. The law puts on the operator the onus for checking the route qualifications of the designated pilot, whether for a scheduled or a non-scheduled service. The law is prescribed in Article 22, Part B, of the Tenth Schedule to the Air Navigation Order, 1960. Sections 1(5) and (6) of this schedule prescribe that the commander shall, within twelve months, have demonstrated to the satisfaction of the operator that he has adequate knowledge of the route to be taken, the aerodromes of take-off and landing, and any alternative aerodromes—including in particular his knowledge of the terrain, the seasonal meteorological conditions, communications, ATC facilities and procedures, and so forth. He must also have been tested within six months as to his proficiency in using instrument approach-to-land systems "of the type in use at the aerodrome of intended landing." This test must have been carried out either in flight in IMC (instrument meteorological conditions) or on the ground in IMC simulated by means approved by the Minister.

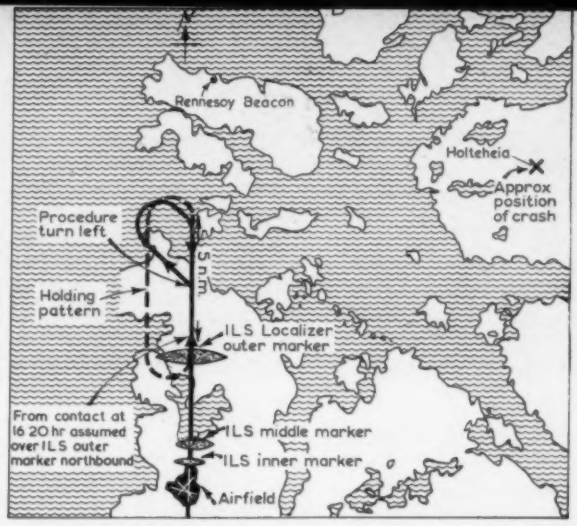
In determining whether a pilot's knowledge is sufficient to perform the flight, the operator can take into account the experience of other members of the crew; the similarity of the instrument approach procedures to those with which he is familiar; the reliability of met forecasts and the probability of different meteorological conditions in the area concerned. It is required that proper records of crew tests shall be kept by the operator. Obviously, one of the objects of the Ministry's investigation will be to determine how Cunard Eagle satisfied themselves as to Capt Watts's knowledge of the route and the airport.

It is up to the Minister to decide whether a public enquiry into the Stavanger accident is held, or whether any of the evidence given to the Ministry in the course of the investigation is published. In the case of the Barcelona accident two years ago, when a Transair DC-3 hit a mountain on a passenger charter flight with the loss of all on board, the evidence given to the Ministry in respect of the crew's route experience was never published.

The Minister can expect to find himself under some pressure to publish the evidence relating to the route qualifications of the Stavanger crew. Not all the thousands of passenger charter flights from the UK to foreign airports operated every year are flown by operators as competent and reputable as Cunard Eagle. The questions that will be asked are: Are the regulations as regards crew route qualifications adequate? How, since the onus for testing is on the operator, are they enforced?

This summary of the preliminary Norwegian report, issued on August 25, takes up the story from the point where the aircraft was cleared to do an instrument landing, when established on ILS flying north towards the ILS outer marker (see map):—

Immediately before 1615 the aircraft reported, at the request of the tower, that it was going down from 4,000ft and that, at the moment, it was passing 3,500ft. At 1618 the tower asked the aircraft to give estimated arrival time over the outer (northern) beacon. In reply the aircraft reported immediately that it expected to be over the radio beacon at Rennesoy (Rennes Island) in two minutes. This beacon is, however, situated about 18 kilometres (about 11 miles) north of the outer beacon



The preliminary report of the Norwegian commission of enquiry into the Cunard Eagle Stavanger accident on August 9 is summarized on this page. This "Flight" map shows the relevant procedures and locations

mentioned, and the tower therefore replied that it supposed the pilot did not mean the beacon at Rennesoy, but the outer beacon.

To this the pilot replied "Roger." It is therefore not absolutely clear whether the pilot had corrected his first report and agreed with the tower in that he meant the outer beacon and not Rennesoy.

At 1620 the aircraft reported that it had passed the outer beacon. Based on the time which had passed from the time the aircraft passed Varhaug, the opinion of the commission is that the aircraft with the estimated time of arrival for the radio beacon at Rennesoy actually meant the arrival time for the outer beacon and not Rennesoy—as the tower had supposed. When the aircraft at 1620 reported that it had passed the outer beacon, it was instructed by the tower to report when it passed the beacon on its way back towards the airport. This should have been done after the aircraft had carried out the prescribed manœuvres to arrive in the correct position for the final procedure and landing. These manœuvres consist in doing the following: (1) One minute's flying north along the ILS beam after passing an outer marker beacon, with descent from 2,000 to 1,500ft; (2) A turn of 45° to the left and one minute's flying out from the radio beam in this direction; (3) A turn of 180° to the right followed by flying in towards the centre line of the radio beam; (4) Flying on the descent along the radio beam southwards to the outer mark beacon where the aircraft should report to the tower; (5) Flight along a straight line with reduction of height along the radio beam to the runway.

By radio communication between the aircraft and the tower at 1620 the tower positioned the aircraft north of the airfield and somewhat to the west of the central line of the ILS beam, that is to say in a direction where it could be expected that the aircraft would be.

Immediately before 1621 the aircraft asked for the QFE for Sola, and this was given. The aircraft acknowledged this message. At 1622 the tower gave the aircraft a revised QFE, and the aircraft acknowledged and thanked. This was the last time the tower had contact with the aircraft. From 1629 the tower called the aircraft repeatedly but without obtaining any answer.

Certain quarters have criticized the fact that the Air Force GCA at Sola is normally in operation only part of the day, and that it was not employed by the control tower when controlling the Viking. It is, however, established that weather conditions in the period of time in question were not so difficult that there was reason for the control tower to ask on its own initiative for the radar system to be put into operation. Other aircraft were, on the same afternoon and under similar weather conditions, cleared in at Sola by the help of the same means and procedures which were employed for the Viking.

It is also established and announced internationally that both the pilot and the control tower can get radar survey or radar control of the landing at Sola by using GCA if this is deemed necessary. Outside service hours, a request must be made 45min in advance in accordance with the aviation directorate announcement of January 5, 1960. No such request was made to or by the control tower at Sola.

LIGHT ON BLIND LANDING

THE British Air Line Pilots Association is to hold an Automatic Landing Forum at the Red Lion Hotel, Hounslow, on October 31, beginning at 10.30 a.m. The guests will represent broadly the principal British designers of automatic approach, landing and taxying equipment, together with government representatives, airline operators and pilots.

The agenda is not yet finalized, but among the principal contributions will be a paper on BALPA policy on the subject, by Capt P. E. Bressey of the Association; an outline of the opinions of

This is a picture which shows, perhaps more compellingly than can words, the meaning of the recent decision by Mr Curt Nicolin, the new president of SAS, to reduce staff by 1,250 in the interests of economy. This picture was taken while Mr Nicolin was addressing ground staff at Bromma Airport, Stockholm

The first Convair jet airliner to visit the United Kingdom landed at London Heathrow on August 23. It was a Swissair Convair 880-M operating a scheduled service from Zurich normally flown by Caravelles. Swissair will inaugurate 880-M services to the Far East on September 10

AIR COMMERCE . . .

Smiths Aircraft Instruments Ltd; and a short paper by Elliott Bros (London) Ltd on the VC10's automatic landing system. Capt F. Ormonroyd of BEA will present a paper entitled "What The Operator Expects from the System," and Mr D. Wilson of General Precision Systems Ltd will read a paper entitled "The Contribution of the Simulator Designer."

THE FIRST APPEAL

THE first appeal from a decision of the Air Transport Licensing Board, by Falcon Airways regarding its Gatwick - Malaga - Tangier inclusive tour, was heard on August 21-22 at Caxton Hall, before Sir Leonard Stone, OBE. As recorded in our June 15 issue the Board rejected the Tangier application, but granted a "compassionate" licence to fly to Malaga from July 2 to August 13 outward and until August 28 for home-bound flights, out of sympathy for the 1,167 passengers who had already booked.

There was some confusion over the licence under which BEA is operating its Tangier service—whether it was A.294, London - Tangier with an optional traffic stop at Gibraltar, or A.293, London - Gibraltar, which should not offer seat availability to Tangier. The Gibraltar - Tangier sector is normally operated by Gibraltar Airways (in which BEA has a 49 per cent shareholding) but BEA operates the sector with the Viscounts used on the London - Gibraltar service. The question of the actual London - Tangier fare compared with the published fare, which differs because of the cabotage fare to Gibraltar, was also raised. Falcon contended that Gibraltar Airways had no right to be heard by the Board as an objector to their application (as a colonial airline it is exempt from the Act); but the Commissioner ruled that the Board had properly exercised its discretion in allowing Gibraltar Airways to be heard.

It transpired from the evidence of Mrs Bines, secretary of the Peterborough Young Farmers' Club, that the club had no knowledge of a request for foreign travel made on its behalf by the Group and Personal Travel agency. It turned out that a letter had been written to BEA by Group and Personal Travel on the instructions of Mr Sinclair of Flightways; though both agents occupied the same address it was said that Mr Sinclair had no connection with Group and Personal Travel. Mr Sinclair said he had the letter written as the result of a telephone conversation with a Mr Taylor, who said he was acting on behalf of the club. Mr Sinclair admitted he had never had Mr Taylor's address and had thrown away his phone number, although he had used the letter as a piece of *bona fide* evidence to the Board in support of Falcon's application. The Commissioner accepted Falcon's assurance that it did not know of this evidence.

[*Leading article: page 359*]

EATING THE MADEIRA CAKE

IF BEA, by chartering Comets to TAP in a private agreement with the Portuguese airline, have obtained a London - Lisbon - Madeira route, why did the corporation recently bother to apply to the ATLB for a licence to operate the route?

By completing such an agreement before waiting for the Board's decision, BEA does not—as might first appear—lay itself open to suggestions that it has acted in contempt of the court in which, only a month ago, it presented its case for a licence to operate the Madeira route. Although there was no mention in BEA's evidence of the corporation's plans (which must have been under contemporaneous discussion) to operate the Madeira route on behalf of TAP, such plans would obviously have materially affected the evidence now being weighed by the Board—perhaps in BEA's favour. BEA's point is that the Portuguese want a reciprocal slice of the Madeira cake, and they have chosen their old friends and partners to do the cutting. They *could* have chosen Alitalia, PanAm, or anyone else.

This, at any rate, is BEA's interpretation of what might impartially be judged as a commercially clever BEA move to out-manœuvre the two independents, British United and Silver City, whose applications for the Madeira route were heard by the Board at the same time as was BEA's application.

As from December 6, as an extension of the existing consortium agreement between BEA and TAP (whereby BEA Comet 4Bs operate virtually all BEA and TAP services between London and Lisbon), Comets chartered from BEA, and wearing TAP transfers, will operate the cabotage route from Lisbon to Porto Santo, whose new airport will by then be in operation. Ferry boat connections will be operated between Porto Santo and Funchal, the capital.

BEA's application to the Board was for a licence to operate the service they have now obtained by private arrangement with the Portuguese. The main difference, it would appear, will be in the distribution of revenues on the Lisbon - Madeira sector; the terms of the agreement between BEA and TAP are, as usual in the case of a pool agreement, confidential. But since the Lisbon - Madeira sector is Portuguese cabotage, presumably all the proceeds go to TAP, less the cost of the charter. Whether this is the arrangement that has been made, and whether it will be altered if the Board grants BEA a licence to operate in its own right, may never be known. The arrangements certainly should be known to the Board, which has confidential access to pool agreements, if it is to make a proper judgment in this case. The development of British civil aviation, which it is the Board's duty to further, cannot be furthered if it is not known what a British operator earns out of operating a route.

The essential fact is that BEA will be first on the London - Madeira route, and with jets. The corporation says that there is no agreement between BEA and the Portuguese giving BEA exclusive British rights to the route. There is thus no plot to keep out BUA or Silver City should it be the purpose of the Board to license either or both of these independents.

The hearings before the Board into the BEA, Silver City and British United Madeira applications were summarized in *Flight* for August 10, pages 199 and 200.

Mr J. K. G. Gregory of The Merchant Navy and Airline Officers' Association took up his duties on September 1 as manager, personnel services, of British United Airways. He is based at Gatwick

MORE PAYLOAD-RANGE FOR THE HERALD

HANDLEY PAGE announce an increase in the all-up weight of the Dart Herald, from 40,000lb to 43,000lb. This enables it to operate over longer stages with its maximum payload of 56 passengers and baggage, overcoming any payload limitations there may be on shorter stages.

A strengthened undercarriage will be necessary to take the extra weight and this can be fitted retrospectively to the initial production batch of 21, which will be completed to the 40,000lb gross weight standard. The 22nd and subsequent aircraft will have the strengthened undercarriage for operation at 43,000lb.

Footnote: BEA will receive the first of their Dart Heralds this autumn, two and a half years after Mr Aubrey Jones, the then Minister of Supply, announced the Government's intention of buying the type for BEA to enable its "early introduction into service," and a year after Lord Douglas complained in public that delivery of Heralds had been held up by the Ministry of Aviation.

MARCONI

sixty series

. . . a new generation of airadio equipment

DESIGN FOR RELIABILITY

AD 160 VHF COMMUNICATION
AD 260 VHF NAVIGATION
AD 360 AUTOMATIC DIRECTION FINDING

MARCONI *sixty series*

SPECIFIED BY
B.O.A.C. FOR VICKERS VC. 10
B.E.A. FOR D.H. TRIDENT

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND

A10

Graseby

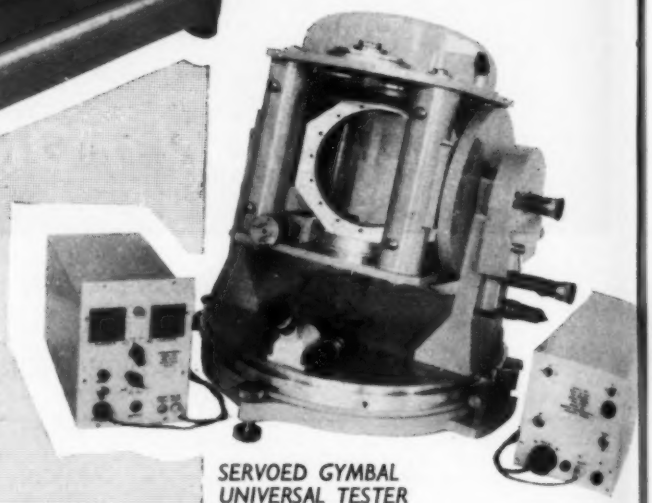
Gyro Testers for Inertial Navigation

EUROPE'S LARGEST SUPPLIERS OF PRECISION GYROSCOPE TEST EQUIPMENT

The most comprehensive range of Gyro Test Equipment available anywhere.

As supplied to The Ministry of Aviation, The Admiralty and the leading manufacturers in the Gyro industry.

POLAR AXIS TABLE 657



SERVOED GYMBAL UNIVERSAL TESTER TYPE GI 390

SEE STAND No 179

SBAC SHOW FARNBOROUGH SEPT 4-10

GRASEBY INSTRUMENTS LTD

KINGSTON-BY-PASS ROAD TOLWORTH · SURREY *Phone: ELMBRIDGE 5742/3*

AIR COMMERCE...

THE AIRLINES' Shopping List

THE eighth *Flight* airlines' shopping list appears on this and the next page. Like its predecessor, published on January 8, 1960, it includes military, government and executive orders, and military variants of current transport aircraft such as the Boeing KC-135 and Canadair CC-106. Inclusion of military orders helps to put a civil production programme into perspective, particularly in the case of US aircraft. Russian aircraft are excluded.

Following the usual practice, options are not included but resales and leases are. A characteristic of the present shopping list is that while orders themselves have not increased all that much, the numbers of resales and leases—particularly of Boeing 707s and Viscounts—since the last list have grown considerably. American has recently sold five Electras to the Brazilian carrier REAL, and there may be more Electra resales to come.

Types new to this shopping list are the Argosy, BAC One-Eleven, Boeing 727, Convair/Canadair 540, Allison-Convair and ATL-98 Carvair (sole representative of the piston-engined breed). The last three types reflect the trend towards conversions.

The current shopping list is longer because of the inclusion of new variants as well as new orders; many of the types listed in the previous shopping list have since blossomed out into a family of variants. Probably the most important single trend discernible in the current list is the growing acceptance of the turbofan reflected

[*Continued at foot of page overleaf*

Aircraft	Variant	Powerplant	Customer	Total
D.H.121 Trident	Mk 1	RB.163 Spey	BEA, 24 (from late 1963 to September 1965)	24
D.H.106 Comet	Mk 4	RA.29/1 Avon 524	BOAC, 19 (complete); Aerolineas Argentinas, 6 (complete); EAAC, 3 (current)	63
	Mk 4B	RA.29/1 Avon 525B	BEA, 14 (complete); Olympic, 4 (complete)	
	Mk 4C	RA.29/1 Avon 524	Mexicana, 3 (2 leased to Guest Aerovias Mexico); United Arab Airlines, 5 (current); MEA, 4 (complete); RAF Transport Command, 5 (1962)	
Avro 748	Series 1	RDa.6 Dart 514	Skyways, 3 (1961-2); BKS, 5 (1962); Indian Air Force, 4 (India holds a licence to build); Aerolineas Argentinas, 9	24
	Series 2	RDa.7 Dart 531	Aden Airways, 3 (1962)	
AW.650 Argosy	Series 100	RDa.7/2 Dart 526	Riddle, 7 (current); BEA, 3 (November 1961 - February 1962)	66
AW.660 Argosy	C. Mk. 1	RDa.8 Dart 101	RAF Transport Command, 56	
Vickers VC10		RCo.42-1 Conway 540	BOAC, 15 (November 1963-August 1964) (including 2 for Nigeria Airways); Ghana Airways, 3 (1963-4); British United, 4 (1964)	52
Super VC10		RCo.42-3 Conway	BOAC, 30 (October 1964-October 1966)	
Vickers Vanguard	950 series	Rolls-Royce Tyne	BEA, 6 V.951 (complete), 14 V.953 (current); TCA, 23 V.952 (current)	43
Vickers Viscount	700 & 800 series	Rolls-Royce Dart	*See list below*	429
BAC One-Eleven		RB.163 Spey 505-14	British United, 10 (from September 1964)	10
Bristol Britannia	100	Proteus 705	BOAC, 15 102 (complete)	81
	252 (C. Mk 2)	Proteus 765	RAF, 3 (complete)	
	253 (C. Mk 1)	Proteus 255	RAF, 20 (complete)	
	300 series	Proteus 762	Ministry of Supply, 1 301 (complete); Aeronaves de Mexico, 2 302 (complete); British United, 2 307 (complete); Transcontinental, 2 308 (complete); Ghana Airways, 1 309 (complete)	
	310 series	Proteus 765	BOAC, 14 312 (complete); El Al, 4 313 (complete); CPAL, 6 314 (complete); British United, 2 317 (complete); Cubana, 3 318 (complete); Cunard Eagle, 1 318 (leased from Cubana); BEA, 1 312 (leased from BOAC); BWIA, 1 312 (leased from BOAC); Ghana Airways, 1 319B (ex-BOAC)	
	320 series	Proteus 765	Cunard Eagle, 2 324 (ex-CPAL) (leased from Bristol)	
Handley Page Herald	100 series	RDa.7/2 Dart527	Jersey Airlines, 2 (leased from Handley Page); MoA, 3 (for BEA); North-South Airlines, 1 (1961)	14
	200 series	RDa.7/2 Dart 527	Jersey Airlines, 6 (from summer 1961) Mar. Central, 1 (1961-2); Nordair, 1 (1961-2)	
Boeing 707	-120	Pratt & Whitney JT3	PanAm, 6 -121 (complete) (2 leased to Avianca); American, 26 -123 (complete; being converted to -123B standard); Continental, 5 -124 (complete); TWA, 15 -131 (complete); Qantas, 7 -138 (complete; being converted to -138B standard); Western, 2 -139 (leased from Boeing); US Air Force, 3 VC-137A (complete)	207
	-120B	Pratt & Whitney JT3D	Qantas, 4 -138B (current; one leased from Boeing); TWA, 20 -131B (1962)	
	-220	Pratt & Whitney JT4	Braniff, 5 -227 (complete)	
	-320	Pratt & Whitney JT4	PanAm, 20 -321 (complete) (1 leased to Pakistan International), 6 -331 (bought from TWA, complete); Air France, 20 -328 (complete); Sabena, 7 -329 (current); TWA, 12 -331 (complete); SAA, 3 -344 (complete)	
	-320B	Pratt & Whitney JT3D	PanAm, 5 -321B (1962); TWA, 6 -331B (1962)	
	-420	RCo.12 Conway 508	BOAC, 15 -436 (complete); Lufthansa, 5 -430 (complete); Air-India, 6 -437 (current); Varig, 2 -441 (complete); El Al, 3 -458 (current); Ghana Airways, 2 (1962); Cunard Eagle, 2 -465 (1962)	
	KC-135A	Pratt & Whitney J57-P-31	561 ordered for the USAF; over 460 delivered; two in use by the FAA	591
	C-135A	Pratt & Whitney 57-P-59W or Pratt & Whitney TF33	MATS, 30 (current) (first 15, powered by J57s, will be re-engined with TF33 turbofans; remaining 15 will be TF33-powered)	
Boeing 720	707-020	Pratt & Whitney JT3	United, 29 -022 (current); American, 10 -023 (complete; to be converted to -023B); Aerlinte Eireann, 3 -048 (complete); Braniff, 4 -027 (current); Eastern, 15 -025 (1961-2); Pacific Northern Airlines, 2 -062 (1962); FAA, 1 -027 (1961)	64
Boeing 720B	707-020B	Pratt & Whitney JT3D	American, 15 -023B (current); Lufthansa, 8 -030B (current); Western, 4 -047B (current); Avianca, 2 -059B (current); Ethiopian, 2 -060B (1962); Northwest, 9 (current); Pakistan International, 3 (1961-2); Continental, 4 (1962); TWA, 4 (leased from Boeing); El Al, 3 (1962)	54
Boeing 727		Pratt & Whitney JT8D-1	Eastern, 40 (1963-4); United, 40 (1963-4); Lufthansa, 12 (1964); American, 25	117

[**Table continued overleaf**

Vickers-Armstrongs Viscount (all models). The following list of confirmed orders accounts for 429 aircraft, as follows: BEA, 27 V.701 (Dart 506), 24 V.802 (Dart 510), 19 V.806 (Dart 520); BWIA, 1 V.702 (Dart 506), 4 V.772 (Dart 506); Aer Lingus, 6 V.808 (Dart 510), 1 V.805 (ex-Eagle); Air France, 2 V.708 (Dart 506); TAA, 7 V.720 (Dart 505/6), 7 V.756 (Dart 510), 2 V. 816 (Dart 525); Indian Air Force, 1 V.723 (Dart 506), 1 V.730 (Dart 506); TCA, 15 V.724 (Dart 506), 36 V.757 (Dart 506); British United (ex-Hunting-Clan), 1 V.732 (Dart 506), 3 V.833 (Dart 530).

British United (ex-Airwork), 2 V.736 (ex-Fred Olsen), 2 V.831 (Dart 525); British United (ex-Transair), 3 V.804 (Dart 510); Pakistan Government, 1 V.734 (Dart 506); Iraqi Airways, 3 V.735 (Dart 506), 1 V.773 (Dart 506); Fred Olsen, 4 V.779 (Dart 510); Canadian Government, 1 V.737 (Dart 506), 1 V.797 (Dart 510); United Arab Airlines, 2 V.732 (ex-Hunting-Clan), 6 V.739 (Dart 506); United, 47 V.745 (Dart 510); Central African Airways, 1 V.754 (ex-MEA), 5 V.748 (Dart 510); LAV, 3 V.749 (Dart 506); MEA, 6 V.754 (Dart 510); Icelandair, 2 V.759 (ex-Hunting-Clan); Malayan, 2 V.760 (ex-Hong Kong Airways); UBA, 2 V.761 (Dart 510).

TACA, 1 V.763 (Dart 510), 2 V.786 (Dart 510); US Steel Corp., 3 V. 764 (Dart 510); Standard Oil, 1 V.765 (Dart 510); Indian Airlines Corp., 10 V.768 (Dart 510); KLM, 9 V.803 (Dart 510); New Zealand NAC, 4 V.807 (Dart 510); Continental, 13 V.812 (Dart 525); South African Airways, 7 V.813 (Dart 525); Iranair, 3 V.782 (Dart 510); Lufthansa, 10 V.814 (Dart 525); Philippine Air Lines, 3 V.784 (Dart 510), 1 V.745 (ex-Capital); Alitalia, 10 V.785 (Dart 510), 5 V.745 (ex-Capital); South African Government, 1 V.781 (Dart 510); Pakistan International, 5 V.815 (Dart 525); Cubana, 3 V.818 (Dart 525); Brazilian Government, 1 V.742, 1 V.789 (Dart 510); PLUNA, 3 V.769 (Dart 510).

Maritime Central, 1 V.805 (ex-Eagle); Cunard Eagle, 2 V.707 (ex-Aer Lingus), 2 V.755 (ex-Cubana); Turk Hava Yollari, 5 V.794 (Dart 510); VASP, 6 V.827 (Dart 525); Ansett-ANA, 2 V.747 (Dart 506), 1 V.812 (ex-Continental), 4 V.832 (Dart 525); Northeast, 10 V.798 (Dart 510); Kuwait Airways, 1 V.761 (leased from UBA), 1 V.707 (leased from Tradair); Kuwait Oil, 1 V.776; Sudan Airways, 1 V.831 (Dart 525); S. J. Groves & Sons (Minnesota), 1 V.793 (Dart 510); Tennessee Gas Transmission Co., 1 V.835 (Dart 525), 1 V.812 (ex-Continental); Mr & Mrs H. May, 1 V.786 (ex-Lanica); All Nippon, 2 V.744 (leased from Vickers), 6 V.828 (Dart 525); Austrian Airlines, 2 V.745 (ex-Capital), 6 V.837 (Dart 525); Ghana Airways, 3 V.838 (Dart 525); Undisclosed buyer (executive), 2 V.810 (Dart 525); Deutsche Flugdienst, 1 V.814; Tradair, 1 V.707 (ex-Aer Lingus); Maitland Drewery, 3 V.708 (ex-Air France) (two leased to BKS); Starways, 2 V.708 (ex-Air France); Air Vietnam, 2 V.708 (ex-Air France); Air Inter, 1 V.708 (leased from Air France); Union Carbide Co., 1 V.816 (Dart 525); HIM The Shah of Iran, 1 V.816 (Dart 525); Bahamas Airways, 3 V.702 (ex-Kuwait Airways); Danish Air Charter, 2 V.708 (ex-Air France).

AIR COMMERCE...

THE AIRLINES' SHOPPING LIST (continued from previous page)

Aircraft	Variant	Powerplant	Customer	Total
Convair 880	Model 22	G.E. CJ-805-3	TWA, 20 (current); Delta 17 (current); Northeast, 6 (lease-purchased from Convair); Hughes Tool Co., 4, (current)	95
	Model 22M	G.E. CJ-805-3B	Alaska Airlines, 1 (1961); Swissair, 2 (leased from Convair); VIASA, 2 (1961); Civil Air Transport, 1 (current); JAL, 5 (1961-2); FAA, 1	
Convair 990		G.E. CJ-805-23	American, 25 (1961-2); Swissair, 7 (1962) (2 to be leased to SAS); SAS, 2 (1962) (plus 2 leased from Swissair); REAL, 3 (1962)	
Convair/Canadair 540		Napier Eland 504A	Allegheny, 5 conversions (complete); Quebecair, 3 (one leased from Canadair); RCAF, 10 CC-109 (complete); Caribair, 3 (1961)	21
Super Convair		Allison 501-D13	Lake Central, 5 conversions (complete); FAA, 5 conversions (current); General Motors, 3 conversions (current); Ford Motor Co. 1 conversion (current); 9 more conversions current for executive owners.	23
Canadair CL-44	CL-44D4	RTy.12 Tyne 515	Flying Tiger, 10 (current) (2 to be leased to Overseas National); Seaboard World, 5 (current); Slick, 4 (from September, 1961)	31
	CC-106	RTy.12 Tyne 515	RCAF, 12 (complete)	
Douglas DC-8	Series 10	Pratt & Whitney JT3C	United, 21 (complete); Delta, 6 (complete)	172
	Series 20	Pratt & Whitney JT4A	United, 16 (complete); Eastern, 16 (current); (1 leased to Aeronaves de Mexico); National, 3 (complete)	
	Series 30	Pratt & Whitney JT4A	PanAm, 19 (complete); Panagra, 4 (complete); Panair do Brasil, 2 (complete); KLM, 7 (1 leased to VIASA); SAS, 7 (complete); JAL, 5 (current); Swissair, 4 (current); UAT, 2 (complete); TAI, 3 (current); Northwest Orient, 5 (complete)	
	Series 40	RCo.12 Conway 509	TCA, 11 (current); Alitalia, 10 (current)	
	Series 40	RCo.15 Conway	CPAL, 4 (current)	
	Series 50	Pratt & Whitney JT3D	United, 3 (current); KLM, 6 (current); National, 7 (1961-2); Trans-Caribbean Airways, 1 (1961); Iberia, 3 (current); Philippine Air Lines, 2 (1962); Aeronaves de Mexico, 1 (1961); JAL, 1; Delta, 3 (April-July 1962)	
Aviation Traders ATL-98 Carvair		Pratt & Whitney Twin Wasp R-2000-7M2	Channel Air Bridge, 10 (1961-2); East Anglian Flying Services, 1 (1961-2)	11
Sud Caravelle	Mk 1, 1A	RA.29/1 Avon 522, 526	SAS, 12 (complete); Varig, 2 (complete); Finnair, 3 (complete); Air Algerie, 3 (complete); Royal Air Maroc, 1 (complete)	116
	Mk 3	RA.29/3 Avon 527	Air France, 33 (12 converted from Mk 1 & 1A) (including 2 for Air Liban and 1 for Tunis Air); SAS, 11 (8 leased to Swissair); Finnair, 1 (1961); Air Algerie, 1 (complete); Royal Air Maroc, 1 (complete); Alitalia, 4 (complete)	
	Mk 6	RA.29/6 Avon 531	Sabena, 8 (current); Air Algerie, 2 (1961); Alitalia, 10 (current)	
	Mk 6R	RA.29/6 Avon 532R	United, 20 (current); Iberia, 4 (1962)	
	Mk 7	G.E. CJ-805-23C	General Electric, 1 (complete)	
Lockheed Electra	L.188	Allison 501-D13	Eastern, 34 (complete); American, 30 (complete); Braniff, 9 (complete); National, 14 (current); Western, 12 (complete); Allison, 1 (complete); Garuda, 3 (complete); Pacific Southwest, 4 (complete); Cathay Pacific, 2 (complete); Ansett-ANA, 3 (complete) TAA, 3 (complete); TEAL, 3 (complete); Private owner, 1 (in storage); REAL, 5 (ex-American Airlines); FAA, 1 (current); Pacific Missile Range Support Group, 1 (ex-Capital; leased fom Lockheed)	166
	L.188C	Allison 501-D13	KLM, 12 (complete) (1 leased to Air Ceylon); Northwest, 18 (current); Eastern, 6 (complete); Qantas, 4 (complete) (1 leased to TEAL)	
	P3V-1 Orion	Allison T56-A-10W	To be produced for the US Navy as an ASW aircraft. Believed at least 150 to be built	
Fokker F.27 Friendship	Series 100	RDa.6 Dart 511	Aer Lingus, 7 (complete); ALA Austral, 4 (March-April 1962); Braathens SAFE, 2 (complete); East-West Airlines, 1 (complete); Indian Airlines Corp, 5 (complete); HIM The Shah of Iran, 1 (complete); Iranian Oil, 2 (complete); Netherlands Department of Civil Aviation (Royal Flight), 1 (complete); Philippine Air Force, 1 (complete); Philippine Air Lines, 5 (current); Trans-Australia Airlines, 7 (complete); Australian Department of Civil Aviation, 2 (complete); New Zealand National Airways Corp, 8 (current); Phillips Gloeilampenfabrieken, 1 (current)	105
	Series 200	RDa.7 Dart 528	All Nippon, 6 (current); Ansett-ANA (including Airlines of NSW, Queensland Airlines and Airlines of SA), 9 (complete); Braathens SAFE, 2 (complete); Helmut Horten, G.m.b.H., 1 (complete); Mac.Robertson Miller, 1 (complete); Trans-Australia Airlines, 3 (complete); Pakistan International, 4 (current); THY, 5 (current); Sudan Airways, 3 (current); DETA, 3 (1962) ; DTA, 2; EAAC, 3	
	Freightship	RDa.6 or RDa.7 Dart	KLM, 2 (complete); Royal Netherlands Air Force, 3 (current); Pakistan International, 1 (current); Lufttransport Unternehmen, 1 (current)	
	Troopship	RDa.6 Dart 511	Royal Netherlands Air Force, 9 (current)	
Fairchild F-27	F-27	RDa.6 Dart 511	Abitibi Power & Paper Co, 1 (complete); Aerovias Venezolanas, 5 (complete); Aloha Airlines, 6 (complete); Cameron Iron Works Inc, 1 (complete); Gates Rubber Co, 1 (complete); General Tire and Rubber Co, 1 (complete); International Business Machines Corp, 1 (complete); Johns-Manville Corp, 1 (complete); Landis Tool Co, 1 (complete); Noland Co, 1 (complete); Ozark Air Lines, 3 (complete); Piedmont Airlines, 8 (complete); Quebecair, 3 (complete); Reynolds Tobacco Co, 1 (complete); Trans Mar de Cortes, 1 (complete); West Coast Airlines, 6 (complete); H. K.Porter Inc, 1 (complete)	86
	F-27A	RDa.7 Dart 528	Aerovias Ecuatorianas, 1 (complete); Banco de Mexico, 1 (complete); Bonanza Air Lines, 9 (complete); Butler Aviation (Pepsi Cola), 1 (complete); Champion Spark Plug Co, 1 (complete); Continental Can Corp, 1 (complete); Ideal Cement Co, 1 (complete); Kimberley-Clark Corp, 1 (complete); Olin Mathieson, 1 (complete); Pacific Airlines, 6 (complete); Raytheon, 1 (complete); Reynolds Metal Co, 2 (complete); U.S. Steel, 1 (complete); Westinghouse Electric Corp, 2 (complete); J. H. Whitney, 1 (complete): Murray Co, 1 (complete); Union Carbide, 3 (complete); THY, 5 (current)	
	F-27B	RDa.6 or RDa.7 Dart	Northern Consolidated Airlines, 3 (complete); Wien Alaska Airlines, 2 (complete)	

INTRODUCTION (continued from top of previous page)

both in new orders and in conversion programmes for current jets; apart from some repeat orders from airlines using conventional turbojets, all recent orders for both 707s and DC-8s have specified by-pass or turbofan engines.

Two classes of airline that can now contemplate much more modern equipment than they could a few years ago are the British independents and the US local service carriers. Ozark's order for five BAC One-Elevens, is not yet firm, but several other US local service carriers are interested in the type. British United, besides ordering ten One-Elevens, have also ordered four VC10s.

The Caravelle order book has more than doubled since the last shopping list, and includes the first of perhaps several orders from US domestic carriers. It has not grown as fast as had been hoped (particularly in respect of the GE-powered version) and the French Government has underwritten production up to 200 to keep up the momentum of deliveries. Other French types such as the Super Broussard will surely appear in the next shopping list. The traditional American reluctance to buy non-American equipment is, it seems, crumbling, as is testified not only by United's Caravelle order but by the keen interest already expressed by US operators in the One-Eleven, even though deliveries will not start until 1964. Airlines the world over, it seems, are no longer prepared to accept that virtually all their aircraft must come from the US and Britain.

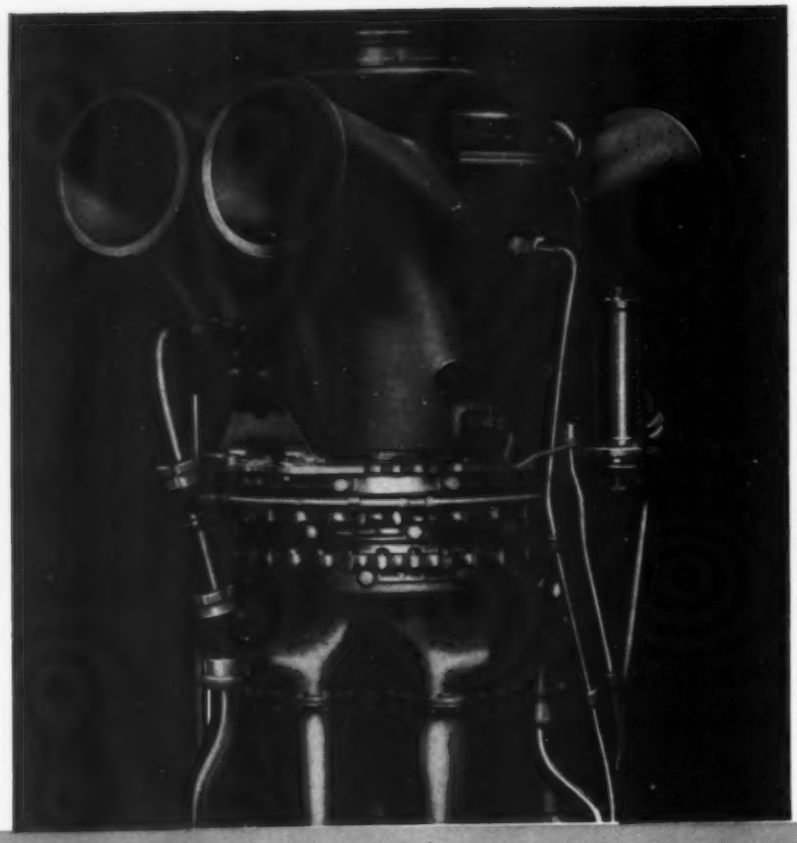
Totals quoted in this shopping list include both aircraft lost in accidents and any aircraft ordered to replace them; totals may not always be the same as the number of aircraft currently operated.

AN AIRCRAFT SEAT IS SOMETHING SPECIAL

Half the fun of flying is doing things in style. Airline operators know that. Passengers expect it and Airlines all over the world know that Microcell aircraft seats are built the way their passengers expect them to be. Comfortable, of course, but with built-in touches which make Microcell seats something special even by aircraft seating standards.
Full data on the complete range—from the sumptuous Executive De Luxe to the comfort-on-a-budget "Travelite" ultra-lightweight seats—is available from the address below.

MICROCELL LIMITED
(A subsidiary of BTR Industries Limited)
9 Kingsway London WC2 COVent Garden 1262

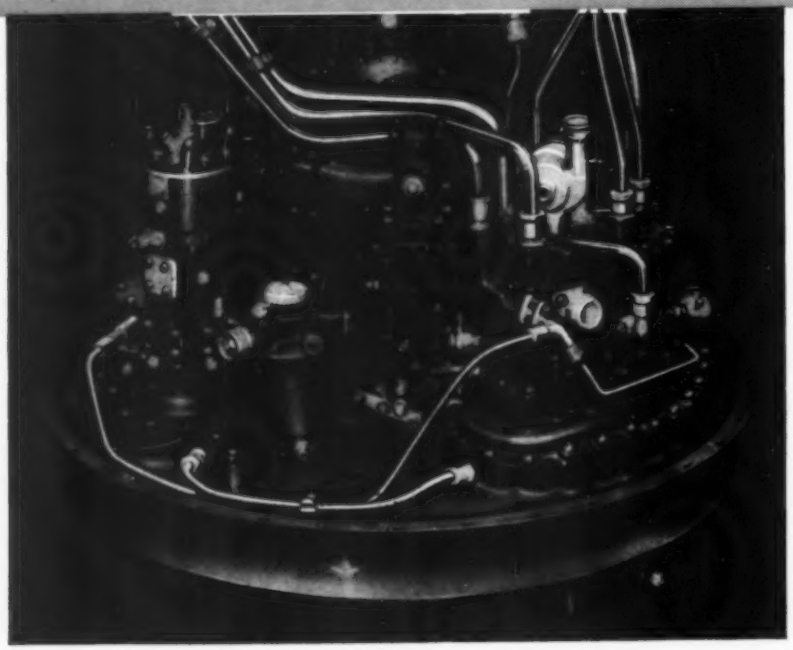
H

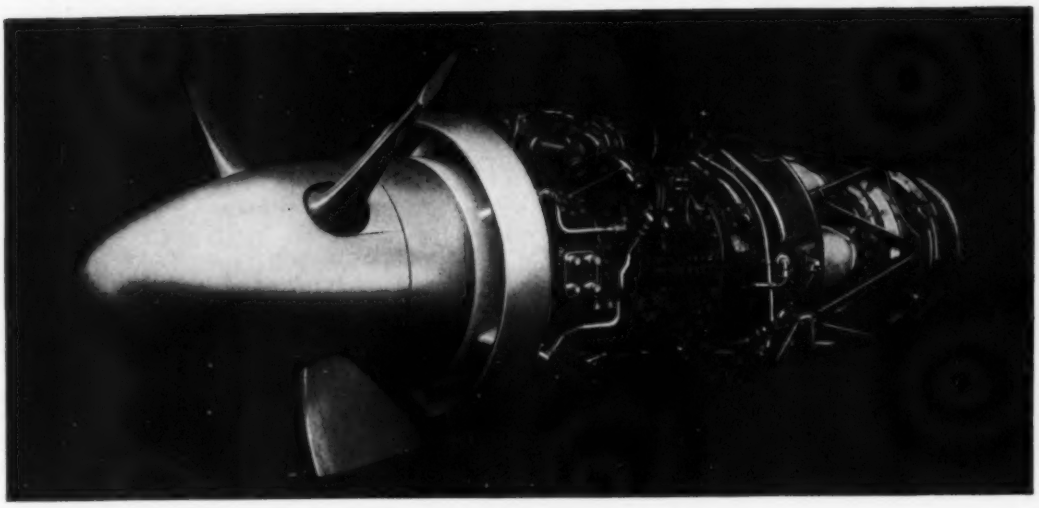


Napier Gazelle - for helicopters

The Gazelle free turbine engine (1,260-2,000 s.h.p.). The ease with which it meets emergency demands has earned it a tremendous international reputation.

NAPIER AERO





Napier Eland – for short-haul operation

The Eland propeller-turbine is designed for new airliners and for conversion of piston-engined aircraft.

ENGINES LTD

THE NEW POWER IN BRITISH AVIATION

NAPIER AERO ENGINES LTD – ENGLISH ELECTRIC – ROLLS-ROYCE · 211 THE VALE · ACTON · LONDON, W3

ELLIOTT AUTOMATION ..

A new concept in Flight Control

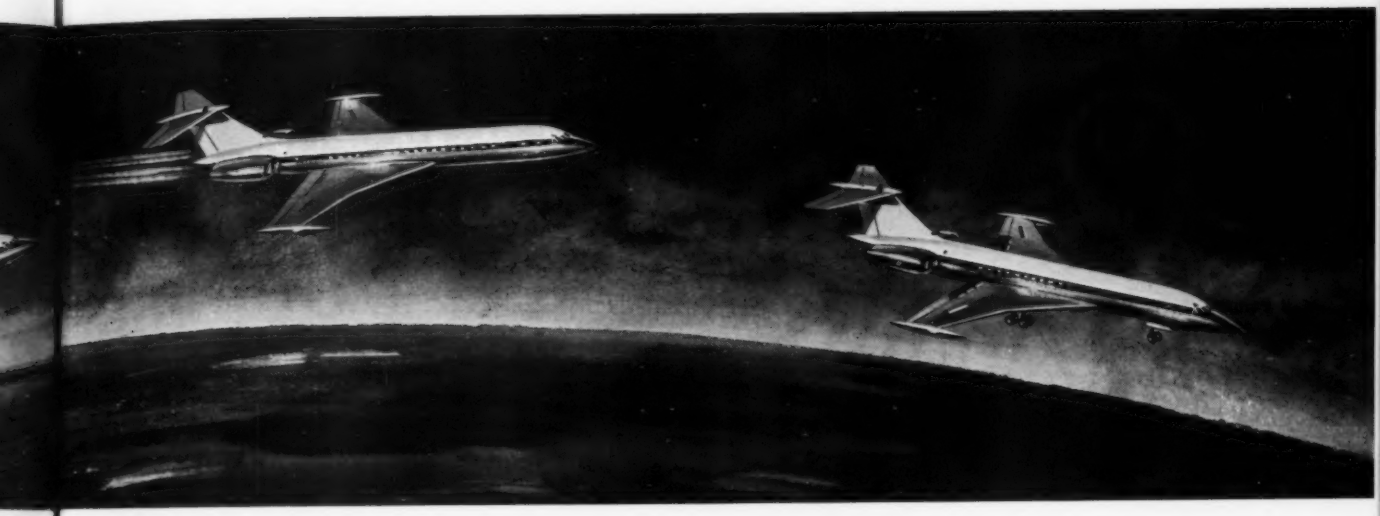
Barely a generation ago two young brothers transformed a dream into reality at Kittyhawk. Today supersonic flight and regular round-the-world schedules are already taken for granted. We are even approaching the time when it will be possible to direct the whole of a commercial aircraft's flight from its point of arrival—even though take-off may be thousands of miles away.

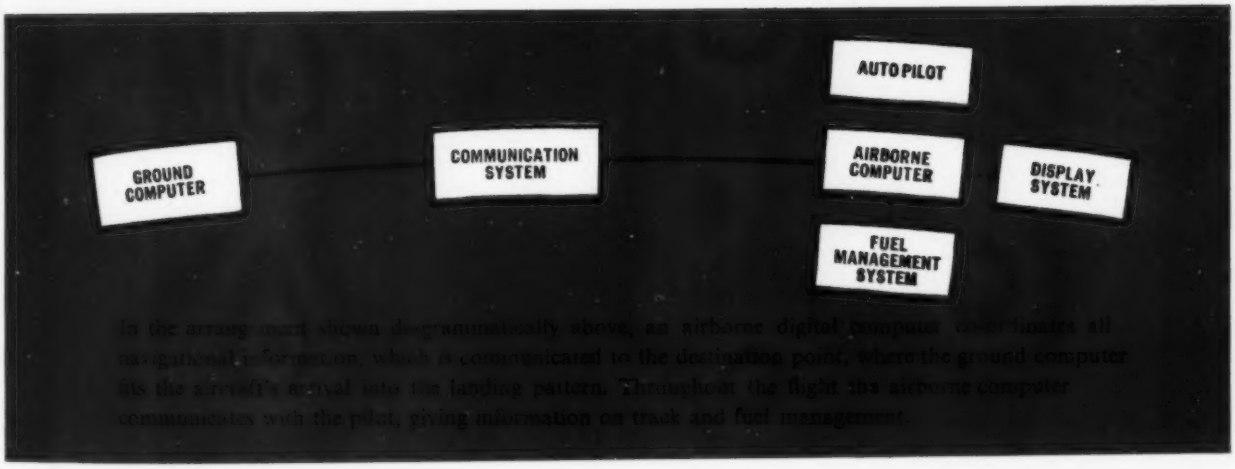
Such an achievement demands sophisticated equipment—tried and tested under all conditions. Elliotts alone are in a position to provide all the necessary equipment from within one group. Very soon Elliotts will transform this dream into reality with an achievement which, a generation hence, will likewise be taken for granted —as indeed are all great achievements.

Visit our Stands 253/254 at FARNBOROUGH

Elliott Brothers (London) Limited invite you to visit Stands 253 and 254 at Farnborough. In the Radar area outside the Exhibition Tent there will also be a Special Demonstration of some of the many different uses of an Elliott general purpose digital computer in the world of aviation.

... take-off to touch-down





In the arrangement shown diagrammatically above, an airborne digital computer coordinates all navigational information, which is communicated to the destination point, where the ground computer fits the aircraft's arrival into the landing pattern. Throughout the flight the airborne computer communicates with the pilot, giving information on track and fuel management.

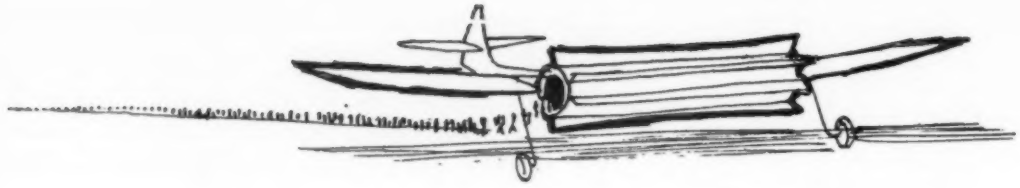
ELLIOTT

A member of the Elliott-Automation Group EA

ELLIOTT BROTHERS (LONDON) LTD

ELSTREE WAY · BOREHAMWOOD · HERTS · TELEPHONE: ELSTREE 2040 · AIRPORT WORKS · ROCHESTER · KENT · TELEPHONE: CHATHAM 44400

AVIATION FUNCTIONS COVERED BY ELLIOTT-AUTOMATION INCLUDE:—SEAT RESERVATION SYSTEMS, AUTOMATIC PRE-FLIGHT CHECKING EQUIPMENT, FLIGHT CONTROL SYSTEMS AUTOPILOTS, INERTIAL NAVIGATION SYSTEMS, AIRBORNE DIGITAL COMPUTERS, FUEL MANAGEMENT SYSTEMS, NAVIGATION AND COMMUNICATIONS EQUIPMENT, RADAR SYSTEMS, TELEMETRY, AIR TRAFFIC CONTROL, BLIND LANDING SYSTEMS, AIRCRAFT INSTRUMENTS SERVICE AND REPAIR, HIGH DUTY RELAYS, SERVO COMPONENTS, SPECIAL PURPOSE HYDRAULIC VALVES, DIGITAL SIMULATION SYSTEMS.



If we were asked for a paint process for this project, we would recommend from our extensive range DOCKERLIGHT 200 PROCESS (D.T.D 5555) —maximum protection—high durability. It's the finish that counts in the end!

S.B.A.C.

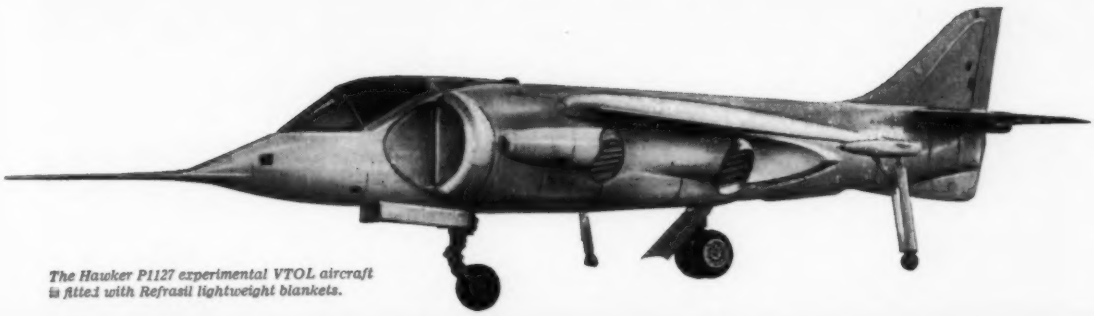
SEE US ON

STAND NO. 250

DOCKERS' AIRCRAFT MATERIALS

DOCKER BROTHERS · LADYWOOD · BIRMINGHAM 16 · EDGBASTON 4111

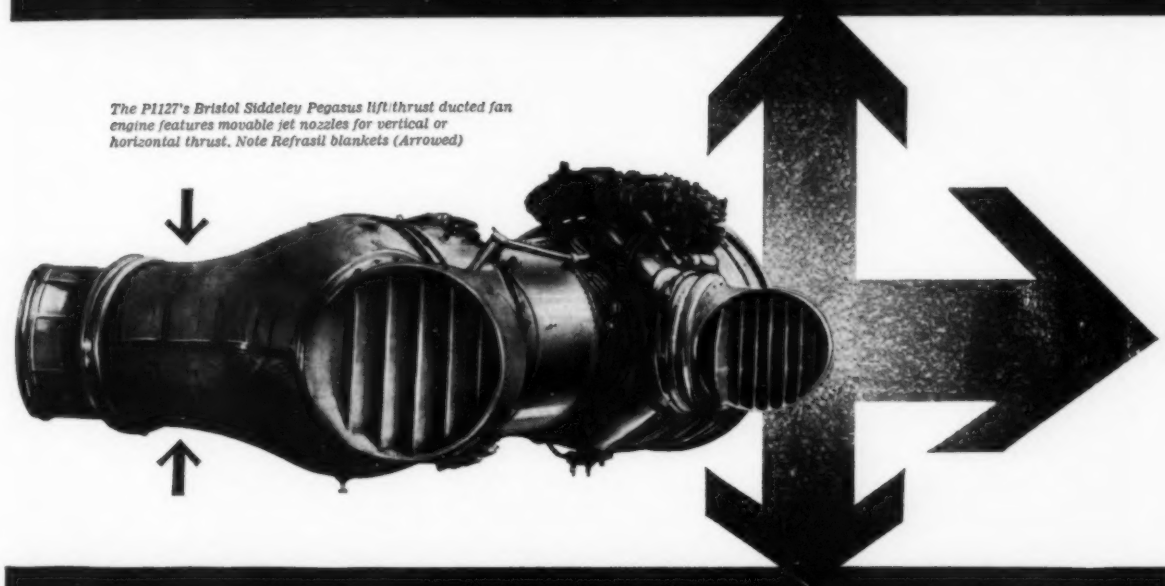
OVERSEAS REPRESENTATION THROUGHOUT THE WORLD



The Hawker P1127 experimental VTOL aircraft is fitted with Refrasil lightweight blankets.

FOR V.T.O. EXPERIMENTAL AIRCRAFT

The P1127's Bristol Siddeley Pegasus lift/thrust ducted fan engine features movable jet nozzles for vertical or horizontal thrust. Note Refrasil blankets (Arrowed)



HIGH TEMPERATURE INSULATION

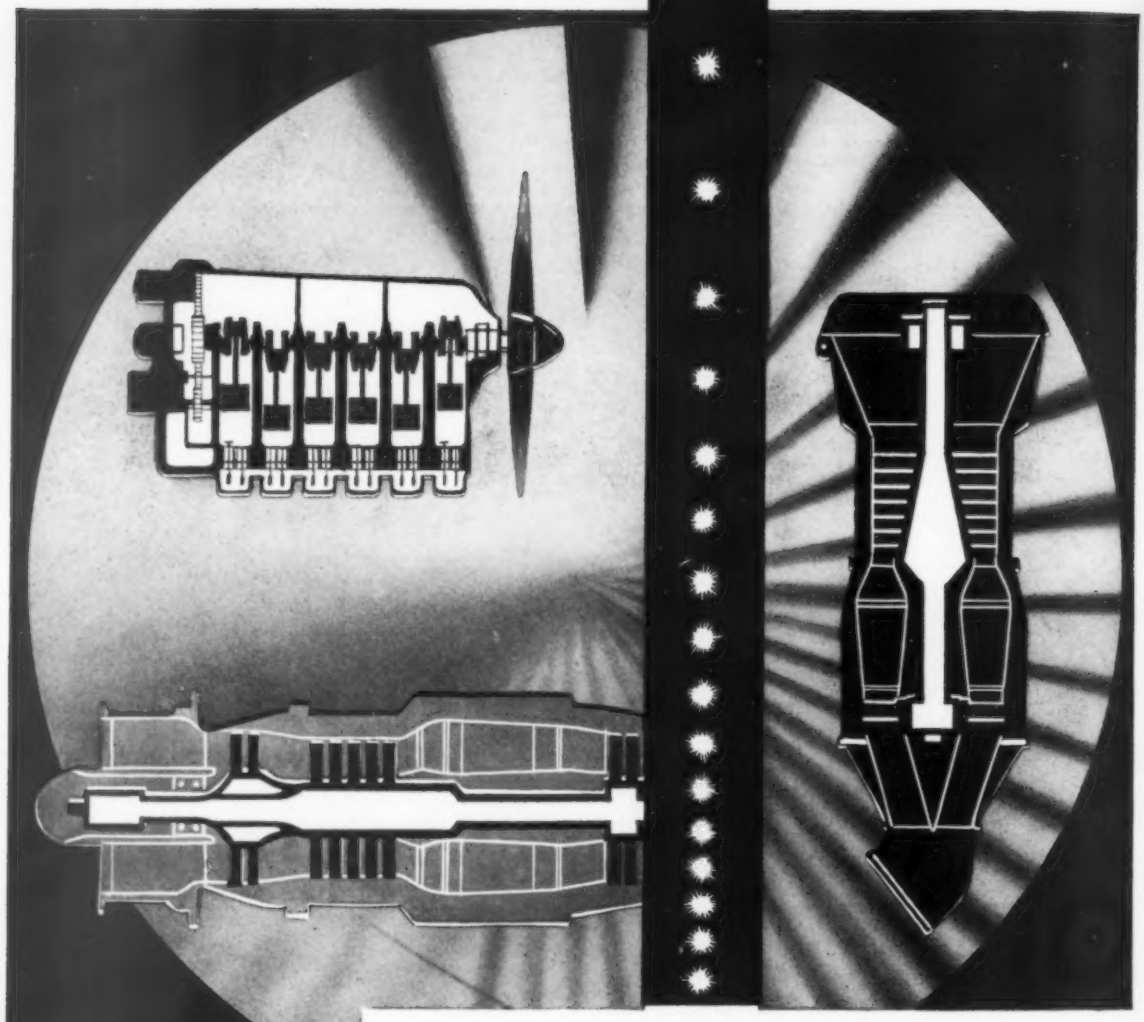
SINCE THE EARLY DAYS of jet aircraft, Refrasil has played a vital part in high temperature insulation. Today Refrasil is used in most experimental projects, including the Hawker P1127 VTOL aircraft, as well as the majority of British production engines and aircraft. Why? Because Refrasil blankets can withstand continuous temperatures of 1,000 C. Further, they are precision made to the specific needs of a development programme or other application. A prototype shop is an invaluable part of the Design, Technical, Advisory and Maintenance services operated by Darchem Engineering before and after sale. And, another production point: no aircraft programme has ever been held up for deliveries. Whenever you have an insulation problem consult Darchem Engineering.

STAND
NO 267

DARCHEM ENGINEERING LTD

STOCKTON-ON-TEES · CO. DURHAM

AEI GETS IT GOING



...AND KEEPS IT GOING

'Ignition on!' and an aircraft power plant bursts into life... AEI power starts it. Every electrical requirement for aircraft is met today by AEI, from ignition equipment for turbine or piston engines, to the supply of switchgear, generator sets, and the development of complete electrical systems for future flight projects. The efficiency and reliability of AEI electrical equipment is appreciated today by manufacturers and operators of leading aircraft of all types.

AEI

Associated Electrical Industries Limited
Aircraft Equipment Group
COVENTRY, ENGLAND

That livestock transportation creates no problems in these days is evident from this picture. The racehorse is one of two being loaded aboard a BOAC DC-7F freighter at London Airport for shipment to Toronto

AIR COMMERCE...

AIRLINER MARKET PLACE

THE current range of Air-Britain publications provide, as usual, news of quite a few hitherto unreported airliner sales and leases of recent months that show that the used airliner market is by no means inactive. For instance, Gulf Aviation has acquired two more DC-3s, one from Aden Airways and the other from Malayan Airways, while Lufthansa has now sold all its DC-3s, the last two going to Bavaria Fluggesellschaft, and CSA has sold a number of its DC-3s to the French Air Force. A newly-formed New Zealand operator, Mount Cook and Southern Lakes Airways, is reported to be buying two DC-3s from NZNAC, while Air France has sold two to Transportes Aériens du Gabon (Transgabon). Another newly-formed New Zealand operator, specializing in scenic flights over New Zealand mountains, is Air Charter (Christchurch), using a D.H. Rapide and a D.H.90 Dragonfly. British United Airways has acquired all the DC-3s operated by the Iraq Petroleum Co, and three of these have been delivered. Airnautic has bought another Viking from Cunard Eagle, and now has six of this type.

Cunard Eagle has bought a DC-6B from Canadian Pacific and a DC-6A from the US non-scheduled carrier Overseas National Airways Inc. A new US "non-sked" is President Airlines, whose two ex-American Airlines DC-6Bs, one of which is named *Woodrow Wilson*, have already operated into this country. Civil Air Transport of Formosa is now operating an ex-American Airlines DC-6A, while UAT has leased at least one of its DC-6Bs to Air Afrique. Air France has sold two of its L.749A Constellations to a French Government body, Secrétariat Général à l'Aviation Civile, for conversion to air-sea rescue work. KLM has cocooned at least six Constellations and four Super Constellations at Schiphol pending sale, while TAP has acquired another L.1049G; it now has four of this type. CSA has acquired a new Il-18, apparently a replacement for the one lost at Casablanca on July 11, while the latest Viscount operator is BKS Air Transport Ltd, who have chartered two of Maitland Drewery's three ex-Air France Viscount 708s for two years. Air Safaris has acquired an extra Hermes from Bahamas Airways, and a second Hermes from Skyways. Among several of the newer British independents starting operations with DC-4s is Lloyd International Airways, which has one aircraft of this type acquired from Loftleidir. This is not the same carrier as Lloyd Airlines Inc, a US "non-sked" whose ex-Braniff L.049 Constellation was seized on August 2 by the Bolivian authorities at Santa Cruz de la Sierra, Bolivia, for alleged smuggling while on a flight from Miami to Uruguay.

UP TO DATE WITH WORLD WIDE

NOW a year old, the UK independent World Wide Aviation was founded in July 1960 and started operations in December of that year, mainly on long-range charters. The fleet comprises two DC-4s, one leased from Trans World Leasing Ltd, the other (an ex-Capital Airlines aircraft) having also been purchased in the USA. Whilst one aircraft has been leased to Sabena since January of this year, and is employed on United Nations charter work, the other has been doing general charter work. World Wide hold an air operator's certificate and have recently been engaged on sub-contract work for travel agents flying home stranded Overseas Aviation passengers. The company's aircraft operations and engineering offices are based at Gatwick; there is a commercial office in Regent Street, and head office is at Prince Consort Drive, Ascot, Berks (tel. Ascot 1092).

World Wide are to supplement their fleet during the coming winter with two additional aircraft, probably DC-6s or DC-6Bs, which they hope to have in service by next summer. Directors of the company are Mr W. J. Bright and Mr F. S. Seary.

There are two other operators trading under a similar title, World Wide Airlines Inc, based at Burbank, California, and World Wide Airways Inc, based at Montreal. The Canadian company inaugurated on August 7 a freighter service, approved by the Canadian Air Transport Board, between Montreal and points in Northern Quebec and Labrador. The service is operated at an initial frequency of two per week with Curtiss C-46 Commandos.

BREVITIES

We regret to record the death of Mr J. J. Busch, general manager of New Zealand National Airways Corp, in Wellington on August 7.

A Morton Air Services Dove has been chartered to fly Herr Brandt, Mayor of West Berlin, for daily speech-making trips to Hanover, Hamburg, Frankfurt, Düsseldorf and other cities in West Germany.

The Chicago Helicopter Airways Sikorsky S-58C accident on July 27, 1960, in which eleven passengers and the crew were killed, is attributed by a CAB accident report to fatigue failure of a main rotor blade.

A new £50,000 engineering and administrative building for Cambrian Airways is to be built at Rhoose airport. Cambrian's aircraft have been maintained by BEA at London (Heathrow), but as from April 1, 1962, Cambrian will carry out all maintenance on its present fleet of Pionairs.

Japan Air Lines has taken delivery of the first of its five Convair 880 Model 22Ms, which is named *Sakura* (Cherry Blossom). JAL's 880s have accommodation for 16 de luxe and 74 economy passengers. Purchase of the first three was financed in part by an ExIm Bank loan.

BEA will operate a special helicopter flight on September 9 from Hendon to Windsor to commemorate the 50th anniversary of the first inland air mail flight. Special souvenir postcards and air mail letters will be carried on the flight, which will be made in collaboration with the British Air Mail Society.

Air Liban has taken delivery of the first of two Caravelles on order, purchased for it by Air France; a Caravelle 3 leased from Air France has now been returned. According to *Interavia* Pan American is still trying to purchase a controlling interest in Air Liban, and negotiations are being held between the two carriers.

According to Mr Charles Froesch, vice-president engineering of Eastern Air Lines, the company foresees a requirement for 40 small twin-jet transports in 1964-66. He specifies "a definite need" for a jet accommodating 48-52 passengers four-abreast, and 60-70 five-abreast. The company is interested in the BAC One-Eleven and the Caravelle 15 (Baby Caravelle), and is also having discussions with Lockheed, Douglas and Boeing.

Cost of a DC-4 Carvair conversion by Aviation Traders is about £105,000, or about £186,000 for a new Carvair less interior and radio with a Check 4, zero hour engines and resealed fuel tanks.

On August 28 the ATL-98 Carvair prototype suffered accidental damage which is likely to delay the flight trials by approximately one month. The aircraft, while stationary, was hit by a carelessly driven road vehicle and suffered damage to the tail structure.

The Falcon-owned Constellation of the Austrian airline Aero Transport that was banned by the Ministry from carrying British passengers six weeks ago has been flying passengers to Palma and Innsbruck with the Ministry's permission, piloted by a Falcon crew.

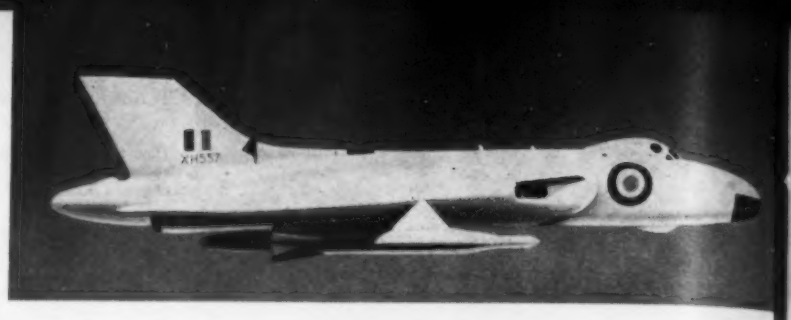
It is reported by *Aviation Daily* that Varig has purchased REAL for an undisclosed price. The deal includes the three Convair 990s scheduled for delivery to REAL in December. Last May Varig purchased a half share in Aerovias Brasilia, REAL's international division. The latest move is subject to Brazilian Government approval.

Starways have been granted a licence by the ATLB to operate from the de Havilland airfield at Chester Hawarden, as well as Liverpool, to London Heathrow. Frequency is restricted to 20 flights a week in each direction and there are no traffic rights between Liverpool and Chester.

BOAC has announced that Mr G. A. K. Matheson, formerly in charge of the passenger handling unit at London Airport, is appointed assistant to manager, London, and Mr A. J. Cutting to be assistant passenger superintendent. Both appointments were effective from September 4.

The air agreement recently concluded in Cairo between the UK and the UAR gives BOAC the right to operate services through the UAR, mainly Cairo and Damascus, without having to obtain temporary permits on every occasion. In return UAA has been granted rights to operate routes beyond London to any point in the USA, and to serve Entebbe, Dar-es-Salaam, Nairobi, Aden, Hong Kong, Singapore and all British colonies.

J



Missiles and Spaceflight

(continued from page 363)

specially built test bed near Sacramento. Observers flying at 2,000ft saw a bright orange flame 350ft in length, and rusty brown smoke which reached to 1,500ft. Mean thrust generated exceeded 500,000lb, and burning time was 87sec. Aerojet-General have studies for clusters of such motors, to provide a solid-fuel back-up to the Nova programme, supplementing the liquid F-1 engine.

First details of US plans for giant solid-propellant boosters were given in *Flight* for July 6, in which a further news-item described Aerojet-General's first firing in this programme. The corporation have not yet begun to design completely flyable, lightweight motors, but it is nevertheless worth noting that they have never yet had any snag in "giant" test-firings (the number of such firings has not been given). A NASA spokesman suggests that a solid booster may lift-off the Apollo which is hoped to put an American on the Moon in 1970.

LOW-LEVEL INTERCEPTION

On August 30 the Ministry of Aviation released a film showing a recent firing of a Bloodhound 2 test vehicle from the RAE Aberporth. The film emphasizes the accuracy of the new continuous-wave guidance system employed with this missile, for the inert weapon actually struck the Meteor target and caused the latter to crash into Cardigan Bay.

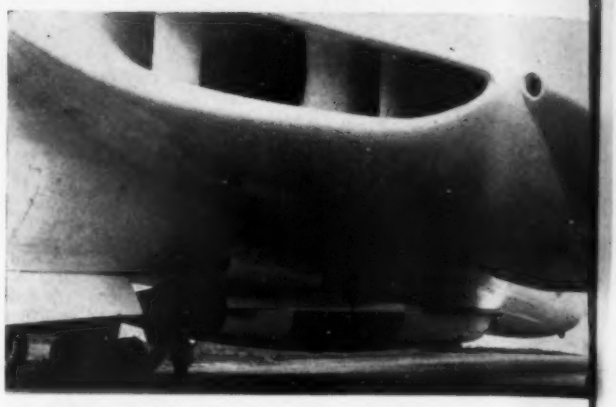
In view of the much greater performance of Bloodhound 2 it is reasonable to suppose that the missile is somewhat larger than Bloodhound 1, and it may well differ in appearance. No such differences could be discerned in the MoA film, and it could well be that this particular development round employed a Bloodhound 1 airframe. It will be recalled that Bloodhound 1 is always launched at an elevation of 45°, but the elevation of this firing seemed to be less than 20°. The target was approaching almost head-on, at a height which appears to have been about 550ft. It will be recalled that Bloodhound 2 has been ordered in quantity by Sweden and Switzerland, as well as by the RAF. Prime contractors are Bristol Aircraft and Ferranti, with ramjet propulsion by Bristol Siddeley engines. Target-illuminating radar is by AEI.

MINUTEMAN No 4 BLOWS UP

In what one observer described as "the biggest explosion ever seen at Cape Canaveral," the fourth XSM-80 Minuteman ICBM to reach the launching pad exploded on August 30 and was totally destroyed. This was the first full-scale firing from an underground silo, which—following promising cut-grain tests at Edwards AFB—has been designed as a simple hole, the first-stage flame passing up the silo in contact with the missile itself.

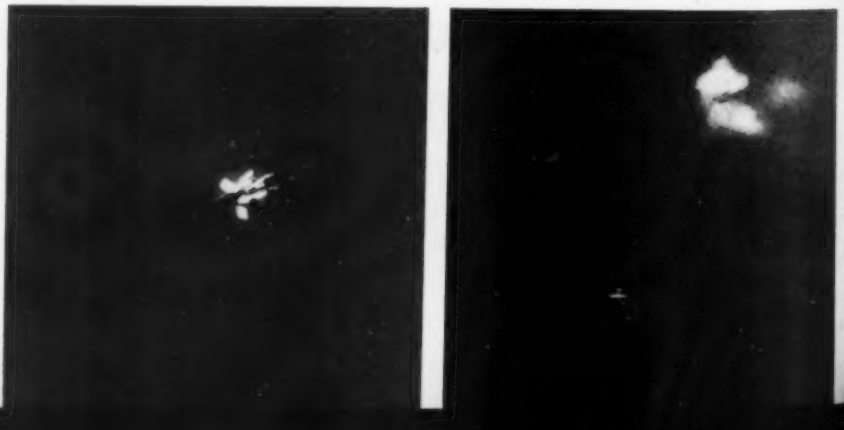
It was at first thought that the second and third stages had broken free during the August 30 launch, exploding within the Minuteman launch complex and leaving the first stage burning in the silo. Investigation showed that, in fact, the complete missile lifted off cleanly and cleared the silo. Then either the control system malfunctioned or the destruct charges exploded. The USAF is confident that operational capability will not be delayed.

Earlier Minuteman launchings took place on February 1 (successful 4,600-mile mission), May 19 (destruction by the range-safety officer about 1min after liftoff) and July 27 (successful 5,000-mile mission). The Minuteman launch complex at the Cape includes two silos and two surface launchers; damage caused on August 30 appears to have been superficial.



Bomber Command's deterrent strength will be substantially increased when its aircraft cease to rely upon free-falling bombs. At the top is a Hawker Siddeley artist's impression of an Avro Vulcan B.2 carrying two Skybolt ballistic missiles; immediately above is a close-up of an Avro Blue Steel guided bomb installed beneath a Handley Page Victor B.2

Below, an excellent photograph of the launch of a Malkara anti-tank missile from the new air-portable vehicle designed to carry it in Royal Armoured Corps service. Further details are given on page 374



As described above, a Bloodhound fitted with a Bloodhound 2 guidance system recently struck a Meteor flying at relatively low altitude over Cardigan Bay. These frames from an MoA film show boost separation and the Meteor about to hit the sea (note smoke from impact at upper right)

Fairey's Hydraulics Division has made more hydraulic power control units than any other company in the world.

VTOL HELICOPTER CIVIL FIGHTER TRANSPORT
PHOTO-RECCE. TRAINING RESEARCH ANTI-SUB. STRIKE
AIRCRAFT

FAIREY ENGINEERING LTD.
A member of The Fairey Group of Companies

HYDRAULICS DIVISION
HESTON · MIDDLESEX

AIRMED

Headsets and Oxygen Masks for high flying aircraft

USED BY MAJOR AIRLINES OF THE WORLD INCLUDING

B.O.A.C. COMET IV's
B.O.A.C. BRITANNIA's
B.O.A.C. BOEING 707's
S.A.S. CARAVELLES
S.A.S. D.C.8's
OLYMPIC AIRWAYS COMET IVB's
AEROLINEAS ARGENTINAS COMET IV's
AEROLINEAS ARGENTINAS AVRO 748's
COMPAGINA MEXICANA DE AVIACION COMET IVC's
MIDDLE EAST AIRLINES COMET IVC's
EAST AFRICAN AIRLINES COMET IV's

Telecommunication headsets
Oxygen masks for Civil and Service aircraft
Chain Toggle Harness
Bone Dome Boom Microphone
Transistor Line Amplifiers
Microphones — Electromagnetic or carbon
Headset testers
Smoke goggles

Airmed LIMITED

HARLOW · ESSEX · ENGLAND

ONE OF THE CLEMENT CLARKE GROUP

Keegan Aviation LTD

Exclusive European Distributors for the Fabulous Riley 65

WHAT IS THE RILEY 65 — a question many interested experts have been asking

★ The Riley 65 is a new aircraft, built on a well-proven and highly efficient airframe, re-engineered to give even greater performance per horsepower.

★ The entire airframe is aerodynamically smoothed and is finished with the same procedure as used on supersonic aircraft giving a cruising increase of 8-10 m.p.h.

★ The engines (choice of 3) are re-installed on improved anti-vibration mountings, and thrust augmenters are fitted below the wings, giving a speed increase of 10 m.p.h. at cruising.

★ The airframe structure is re-engineered, and completely soundproofed. Double thick windows and tinted panoramic windscreen fitted.

★ New super custom interior fitted, with modified instrument panel. A wide choice of colours available.

★ Full IFR radio package incorporated in manufacture consisting of Collins 360 channel VHF transceiver, Collins 90 channel transmitter, 190 channel receiver with VOR and ILS by Collins, Motorola 12E3 ADF and Bendix markers.

★ The result is an aircraft with a most competitive price and a really outstanding performance—e.g. (240 H.P. Model).

215 m.p.h., cruise at 65% power.
160 m.p.h. cruise on one engine.
1,400 mile range as standard.

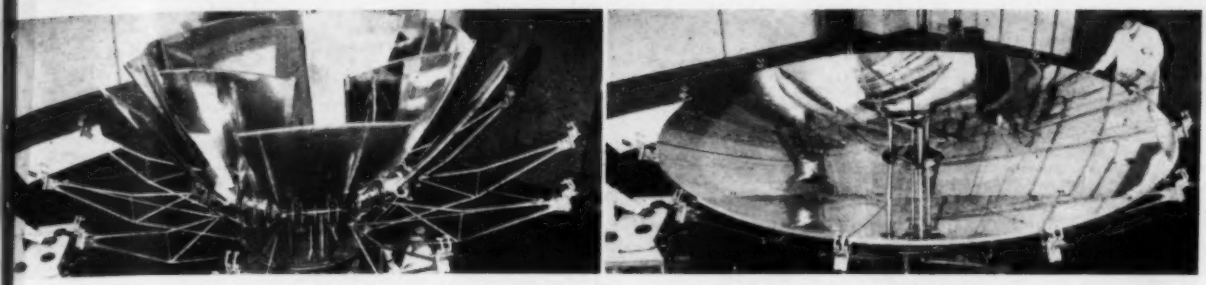
Price £24,500 U.K. Duty Paid.

Outstanding short field performance.

Capable of climbing at 1,300 ft. on one engine at 100 ft. per minute.

Flying is believing—See the Riley 65 *now* at Panshanger

KEEGAN AVIATION LIMITED
PANSHANGER AERODROME, HERTS



Now under development by the US General Electric Company's Missile and Space Vehicle Department at Philadelphia is an experimental solar electrical power system for possible application in spacecraft. This prototype model has individual panels which are folded for launch (left), subsequently extending to form a solar reflector, concentrated heat from which is converted into electricity

Missiles and Spaceflight . . .

CANAVERAL EXPANSION FOR LUNAR LAUNCHES

Approximately 80,000 acres will be added to the existing 17,000 acres of the Air Force Missile Test Center and Cape Canaveral facilities in Florida to accommodate launch sites for manned lunar flights and other missions requiring advanced Saturn and Nova-class boosters. The additional area, which is expected to cost some $60m, will be administered as part of the Atlantic Missile Range by the USAF, acting as agent for NASA.

The selection of the site was made on the basis of "trajectory advantages relating to launch azimuths; hazards of over-flight or booster impact in populated area; speed of expansion in terms of cost, time and land availability; water transportation access; existing instrumentation support; and adjacent air support facilities." The Cape Canaveral expansion will permit construction and operation of six or more large Saturn and Nova-class launch vehicle complexes.

This expansion is one of three major steps now being taken to accelerate the US space programme, following the "man on Moon" goals specified earlier this year by President Kennedy. The other two main developments are (1) a manned spaceflight research centre, and (2) a booster fabrication and test facility. Sites for both of these are currently being investigated.

MORE RANGERS PLANNED

Four additional Ranger spacecraft have been added to NASA's existing Ranger lunar exploration programme, increasing the total number to nine. The mission of the four extra craft will be to transmit to Earth high-resolution television pictures of the lunar surface up to the moment the spacecraft strikes the Moon. The television system will be developed by the Astro-Electronics Division of the Radio Corporation of America. The new Rangers, to be launched by Atlas-Agena B vehicles, will not carry retro-rockets and will strike the surface of the Moon at about 6,500 m.p.h.

The additional Ranger firings imply the addition of a third phase to the Ranger programme. The first phase began with the August 23 launch of Ranger 1, designed as a research and development vehicle to test the advanced spacecraft technology employed in the system. Ranger 1 was designed to operate in a highly eccentric Earth orbit, but instead was injected into a low Earth orbit which nevertheless resulted in a satisfactory test of the spacecraft. Ranger 2 will be fired later this year on a similar mission.

The second phase of the Ranger programme will start next year with the firing of Ranger 3. It will have as its objective the rough landing of an instrumented capsule, containing a seismometer, temperature-measuring devices, a radio and antenna, on the surface of the Moon. Rangers 4 and 5 will be similar to Ranger 3. All spacecraft in the series will be provided by the Jet Propulsion Laboratory, and will be launched from Cape Canaveral.

Last month Capt Walter F. Schlech Jr, USN, took over from Capt Ward as commander of the USS *Proteus* at Holy Loch. A third Polaris-armed submarine, USS *Robert E. Lee*, is now being supported by the base.

Five civilians were killed in a severe explosion at the US Navy's explosives plant at Indian Head, Maryland, on August 25. The building destroyed was a pilot plant for the manufacture of high-energy rocket propellants.

Boeing's Aero-Space Division is using flame-spraying through a stencil in the production of high-temperature strain gauges. These can already operate at 1,200°F, and the limit is expected to be extended beyond 2,000°F.

At least five construction workers were killed, and another eight injured, when one of the pair of 57-ton doors of a Titan launch silo at Lowry AFB fell on them. Other workers escaped by jumping into the safety nets inside the silo.

The contract for penetration-rocket launchers for the Boeing B-52H has been awarded to Northrop Nortronics Division. The launchers and their electronic control equipment will discharge chaff-dispensing rockets ahead of the bomber, to confuse enemy radars.

Discoverer 29 was launched by Thor-Agena B into a 105-335 mile polar orbit from Vandenberg Air Force Base, California, on August 30. An attempt to recover the 300lb re-entry capsule was due to be made. Orbital inclination was 82.1°, and initial period 91.5 min.

An orbital test of the worldwide 16-station Mercury tracking network is planned by the National Aeronautics and Space Administration for "late this summer." A 100lb satellite containing Mercury-type transmitters and receivers will be launched by Scout from Cape Canaveral into a 300-mile orbit.

For at least a year it has been evident that the RAF and Royal Navy may have to purchase either the French Nord AS.30 or US Martin Bullpup in order to provide their aircraft with a tactical strike capability. According to the London *Daily Mail*, both services have agreed upon the AS.30. It is said that " at least 2,000 " will be bought, at a price of more than £4,000,000.

The MA-4 attempt to launch into orbit by Atlas booster an unmanned Mercury spacecraft was postponed indefinitely at Cape Canaveral on August 25 because of faulty electronic equipment. A NASA spokesman stated: "Technical difficulties in an electronic component revealed during check-out and preparation for the Mercury-Atlas 4 mission have forced an indefinite delay in the launching."

Recent launchings include: August 18, Polaris A-2X, destroyed by range-safety officer 33sec after launch from surface ship nine miles off Cape Canaveral; August 11, experimental Aerobee Junior, first successful underwater launch of liquid-propellant rocket from 9ft depth in basin of Aerojet-General's plant at Azusa; August 23, Atlas D, successful launch by US Air Force from Vandenberg; August 23, Pershing, impact at designated point down Atlantic Missile Range.

An international meteorological satellite workshop is to be held in Washington, DC, during November 13-22. The National Aeronautics and Space Administration and the Department of Commerce Weather Bureau have invited the directors of meteorological services in over 100 countries to send representatives to the meeting, which will include lectures on the Tiros satellites, research results, data acquisition and future plans; and practical laboratory sessions.

A second-phase feasibility study concerning a 240ft diameter space tracking antenna for Goldstone, California, is to be carried out for the National Aeronautics and Space Administration by the Blaw Knox Company of Pittsburgh, Pennsylvania. NASA's existing Deep Space Instrumentation Facility comprises stations at Goldstone, Woomera and near Johannesburg, the latter two each equipped with one 85ft diameter antenna and Goldstone with two such antennas.

Unofficial reports aver that both the Indonesian Navy and Air Force plan to establish missile schools; and one claims that the former service has already sent officers to West Germany, Japan and Switzerland, to study available equipment. On August 3 Air Marshal Suryadarma, IAF chief of staff, told a class of graduating instructors that Indonesian air power would shortly be based on guided weapons. (Presumably the Indonesian Tu-16 Badger bombers will carry the stand-off missile displayed on this aircraft at Tushino in July.)

Off-stage at Farnborough: the aircraft carrier "Hermes," from which Scimitars of 804 Sqn, Sea Vixens of 890 Sqn and Gannet AEW.3s of 849 Sqn are flying over each day during the SBAC Show

SERVICE AVIATION

Air Force, Naval and Army Flying News

CFE American Visit

SEVEN officers of the Central Fighter Establishment at West Raynham are leaving the UK on September 17 for a four-week visit to US Air Force bases in the United States. Object of the visit is to discuss air defence, weapons development and tactical evaluations with North American Air Defence Command; the team is to be led by Air Cdre E. G. L. Millington, CFE Commandant, accompanied by Wg Cdr D. W. B. Farrer of Fighter Command headquarters. The tour includes visits to Edwards, Nellis, Eglin, Tyndall and Wright-Patterson Air Force bases, to Tactical Air Command and to USAF headquarters in Washington.

Saluting "The Few"

IN Battle of Britain commemorations on September 17 the salute at the march-past by the Trenchard memorial on the Victoria Embankment is to be taken by Marshal of the RAF Lord Newall, Chief of the Air Staff at the time of the battle in 1940. This will follow the thanksgiving service in Westminster Abbey. Lord Newall will be accompanied at the saluting base by the Air Minister, Mr Julian Amery, and the CAS, Air Chief Marshal Sir Thomas Pike.

The Abbey service begins at 3 p.m. and is due to last just over an hour; the Queen is being represented by the Air Secretary, Air Chief Marshal Sir Theodore McEvoy. At the service, the Fighter Command Ensign is being carried by Wg Cdr G. C. Brunner of the UK Air Traffic Service; the parade, consisting of 23 officers and 521 men and women in four columns, is being commanded by Gp Capt A. L. Winskill, OC Duxford.

The parade is to march through Old Palace Yard and the east side of Parliament Square after the service and will enter Victoria Embankment via Bridge Street. As the head of the column reaches the saluting base, at about 4.45 p.m., a formation of 16 all-weather fighters of RAF Fighter Command is to fly over from north to south in four boxes. There will be four Javelins from 25 Sqn, led by the squadron CO, Wg Cdr J. H. Walton, who will be the formation leader; four from 85 Sqn (Wg Cdr S. J. Perkins); then eight Lightnings, which will be appearing for the first time in a Battle of Britain fly-past, drawn from Nos 56 and 111 Squadrons. The formation is to fly at 350kt at a height of 1,200ft.

Reserves Club

TOTAL membership of the RAF Reserves Club, which has just completed its thirteenth year, is now 3,254 compared with 3,090 for 1960-61. The Club, whose headquarters are at 14 South Street, London W1, has had a successful financial year ending on June 30, showing a profit of £893. The club's president is Sir Miles Thomas and membership is not confined to serving and ex-RAF members, but open to those in the aviation industry and with any interest in flying in the widest sense. The committee are willing to accept a limited number of new members on application.

Gp Capt W. L. Brill, the former CO of 467 Sqn, hands a book of squadron names and honours to Maj J. McGrath, director of the Australian War Memorial

Battle Souvenir

ARTICLES on Bomber Command, formation aerobatics, Coastal and Transport Command operations, radar, spaceflight and the RAFA are included in the Battle of Britain 21st Anniversary souvenir book which will be on sale prior to and during Battle of Britain week (September 11-17). Minimum price is 2s, and all proceeds go to the RAF Benevolent Fund and Royal Air Forces Association. The book includes a programme for the "at home" day on September 16 (see "All Quarters" news-item). The CAS, Air Chief Marshal Sir Thomas Pike, writes a foreword on *The Royal Air Force in the World Today*; and among contributors are the DCAS, Air Marshal Sir Ronald Lees; the C-in-C Bomber Command, Air Marshal Sir Kenneth Cross; and Sir George Edwards, executive director, aircraft, British Aircraft Corporation.

Two competitions are announced in the book. One, for Battle of Britain aircraft spotting, offers a first prize of £100; the other is sponsored by Icelandic Airlines, for which the prize is a flight for two to the USA via Iceland, with a six-day stay at a New York luxury hotel.

IN BRIEF

Over £10m has now been disbursed by the RAF Benevolent Fund since its foundation by Lord Trenchard in 1919. Referring to "this very considerable milestone" the Controller, AVM Sir John Cordingley, said that of this total £9,136,868 had been spent since the end of the Second World War.

Aircraft apprentices at No 1 School of Technical Training, Halton, are renovating a Cierva C.30a autogiro for the National Science Museum. They recently (*Flight*, January 27) renovated a Messerschmitt Me163. The autogiro once belonged to 529 Sqn, which was disbanded at Upper Culham Farm in October 1945. This Unit was previously 1448 Flight, and the aircraft was used with a number of other autogiros on radar calibration work.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Pooling Agreements

WHETHER Mr Henry Marking [Correspondence, August 17] takes Roger Bacon seriously or not, he should not overlook the impression created by "Straight and Level's" investigation (ten months before the recent ATLB hearings) into the degree to which BEA's pooling agreements are subject to Ministerial scrutiny.

The results were at variance with what BEA had to say to the Board and to British United Airways, and as a result Mr Marking's remarks were cross-checked with the Ministry.

To imply that this involved some sort of collusion between BUA and Roger Bacon, as Mr Marking suggests in his letter ("a contemporaneous enquiry very similar to that sent by Roger Bacon"), does less than justice to the impartiality of *Flight's* columnist, the barbs of whose writings have, on occasion, been aimed at Corporations and independents alike.

I should have thought that BUA's suspicions of pooling agreements in the broad context of British civil aviation had been made amply clear in the arguments so recently advanced in Therese House. On this score, at least, BUA and Roger Bacon are at one.

London W1 F. A. LAKER,
Executive Director, British United Airways

Fokker Fixation?

YOUR interesting note (Straight and Level, August 10) concerning the "aerobatibility" of a three-engined Fokker aircraft of the 1920s, which incidentally was not the first of its class to be "stunted," recalls to mind a story current at the time. It was told to me by a representative of Armstrong Siddeley Motors Ltd (as it was then) at Croydon Aerodrome, *circa* 1925, and concerns an engineer who was the Armstrong Siddeley representative, supervising the installations of the Lynx engines in the new "Fokker" at the Amsterdam works.

The test flight, I was told, was in the hands of Anthony Fokker himself. The engineer was a passenger occupying one of the standard wicker chairs provided for such people in the cabin.

After the normal flying tests, Mr Fokker passed a note back to his passenger stating "I am going to try a loop." The latter shook his head, waved and indicated with lavish gesticulations that he must not do so, as the seats had no belts. The reply came from the cockpit: "Well, hold tight to the seat." Grabbing the undersides of the seat at each side, the engineer somewhat fearfully awaited the worst.

With his usual superb handling Mr Fokker completed the loop and soon afterwards landed.

The engineer wasted no time in getting up and making for the door. As he did so, in haste, he knocked against the back of the chair, which responded by falling over. It was not fixed to the floor and never had been.

Glasgow SW2 E. D. AYRE

ATLB Policy

YOUR very interesting reports on the 21st hearing of the Air Transport Licensing Board leave one with two impressions: the first is the lack of any clear direction from the Government on the policy to be adopted by the Board, and the second is the difficulty of introducing more competition without running the risk of higher costs.

It is generally recognized that high traffic-density is essential for low-cost operation, and a dilution of traffic on routes of all but the highest density will increase costs. Existing evidence shows that the best arrangement for both airlines and public is to have two competing carriers on a route, if there is sufficient traffic to justify more than one. The addition of third and fourth carriers does not necessarily benefit the travelling public. How, then, can the independents be allowed into the market without being the third carrier?

The Corporations' attitude is that they should develop new routes or stay out of business, but in Europe this would only extend the "hub and spokes" network which is reducing the route density of the existing main-line routes, and would put off still longer the day when fares can be substantially reduced.

If it is really the Government's policy to allow the independents some share in British civil aviation then they must decide *now* what that share shall be, and some of the Corporations' *existing* route licences should be taken away from them and given to the independents. In this way no wasteful competition would take place and no problems of bilateral agreements arise. The transfer of licences could be done gradually so that normal traffic growth would ensure that nobody actually *lost* any business, and by announcing a five- or ten-year transfer programme all concerned could plan ahead.

The best way of splitting up European operations would be to give the independents definite areas on which they could concentrate. In this way there would be no temptation for airlines to open new routes until there was an economic case for them. The Corporations would have to be compensated for the loss of their sales and station organizations, and for goodwill, since whatever policy is adopted they are bound to suffer some initial financial loss for reasons which they cannot be expected to have foreseen.

It is difficult to see how this policy could be implemented by the ATLB without an extension of their existing powers, although there is still time for the regulations to be amended. This might, in the long run, prove to be the best way to "further the development of British civil aviation." And it might be in the public interest too!

London W1 A. SOLOMON

Sabena Accident

IN your issue of July 27 in the article (page 133) "1961 Half-year Accident Record," you list an accident which occurred on February 15 to a Sabena aircraft as "Crashed on finals; runaway autopilot."

My parent corporation, the Bendix Corporation, and the Boeing Corporation are most disturbed by this statement, which is, to the best of their belief, untrue.

Failure of the autopilot was investigated as a matter of routine, but no conclusion has been drawn that the accident can be attributed to such failure.

London W1. E. G. MONK,
Managing Director, Bendix Ltd

Avuncular Connection

WHILST it is a lamentable fact that this country and the Royal Air Force have been left at the post as far as spaceflight is concerned, we can at least claim a personal interest in the second American manned space-shot.

I note from your issue of August 17 that Virgil Grissom served in Korea with the 334th F-I Sqn. You will no doubt be aware that this squadron was originally No 71 (Eagle) Sqn, Royal Air Force, until it was redesignated No 334 Sqn in the 4th Fighter Group, USAF, at Debden.

Having operated with this squadron both when it was in the RAF and in the USAF, I sincerely hope that someone in the Air Historical Branch of Air Ministry will record that we have at least a "quasi-avuncular" connection with astronautics. Indeed this is the nearest we are ever likely to get.

London SW1 P. R. W. WICKHAM,
Gp Capt, RAF (Ret),
Managing Director, Airmotive Supply (London) Ltd

"P.P.O." on the Pillory

MANY people must have been surprised not to have seen replies in *Flight* to the amusing howlers made by "P.P.O." in his "Private View" column. The reason can only be that he writes so much rubbish that no one has yet taken him seriously. However, as he now seems troubled, may I venture the following free translation, paragraph by paragraph, of his contribution in the August 24 issue from air traffic language (which, it seems, is Greek to him) into P.P.L. language? This, I hope, will assist him in following any imminent prosecution. I have left the first words of each of his paragraphs untranslated.

"*In most forms of sport or pleasure . . .*" There are facets which the participants never really understand and, like children faced with a difficult problem, they tend to hit out at those who look after them.

"*The same applies to flying.*" Do you realize, gentle reader, that when they take off for a cross-country flight in what they fondly think is good weather over the whole of Southern England they seldom think of checking to see if their guess is right?

"*For failing to do this . . .*" They get annoyed if someone whose job it is to pick up the pieces—and there are many scattered over England and the surrounding sea—brings the law on them. They don't realize that the present weather at their destination will be history when they get there and they hope with touching faith that it will not change. Some of them even go so far as to cause annoyance to as many airfields that they can think of *en route*, when one telephone call to the parent Meteorological Office would do and also save them much time and expense.

"*Or suppose that if . . .*" Having sent a little message to their

CORRESPONDENCE...

destination asking the air traffic control officer to look out for them and to search for them if they don't arrive, and owing to their not checking the weather, or not having checked their fuel as being sufficient, or wishing for a drink, they land at a diversion. They don't have the sense or good manners to cancel their little message! Believe it or not, they actually get more annoyed if the ATCO does as they requested him to do.

"*Naturally, anyone in his senses would think this far-fetched.*" As the Ministry of Aviation is not a judicial body they can't understand that reports on these stupid irresponsible actions should be sent to the Director of Public Prosecutions.

"*What can we do . . .*" to help the private flier in this country? Surely the answer is obvious: Don't joke about it; shoot P.P.O. and his cronies; and educate the others who need it.

Hythe, Kent — A NON-STATE PIECE-PICKER-UPPER

FORTHCOMING EVENTS

Sept	3-14	8th Anglo-American Aeronautical Conference (joint IAS/RAeS/CAI), London.
Sept	**4-10**	**SBAC Exhibition and Flying Display, Farnborough.**
Sept	6-10	FAI: European Air Tour.
Sept	9-10	Popular Flying Association: Rally, Fairwood Common, Swansea.
Sept	9	British Air Mail Society: Golden Jubilee Exhibition and Dinner, Windsor.
Sept	11-15	Royal College of Advanced Technology, Salford: Course on Noise Measurement.
Sept	11-17	Battle of Britain Week.
Sept	13-17	German Aero Club: 2nd International Sporting Pilots' Rally, Baden-Baden.
Sept	13	Kronfeld Club: USAF Film Evening.
Sept	15	British Interplanetary Society: a.g.m.
Sept	20	Kronfeld Club: "Italian Nationals," by Philip Wills.
Sept	23-24	International Grand Prix for Light Aircraft, Bourges.
Sept	27	Kronfeld Club: USAF Film Evening.
Oct	2-7	12th International Astronautical Congress, Washington DC.

UP AND UP: BRITAIN'S AVIATION EXPORTS

THE story of British aviation exports for fifteen-and-a-half years since the war is summed up in the table and graph below, prepared by the Society of British Aircraft Constructors. With one exception, in 1960, annual totals have grown steadily; and the half-year figure for 1961 showed no departure from this trend.

The climb is maintained, too, in the January-July figure, announced since the graph was prepared. The total for that period, £95m, was some £8m more than for the corresponding period in 1960. Dollar sales accounted for £39m of the total. Sale of engines and parts, amounting to more than £50m, exceeded by £6m the 1960 record total for the seven-month period.

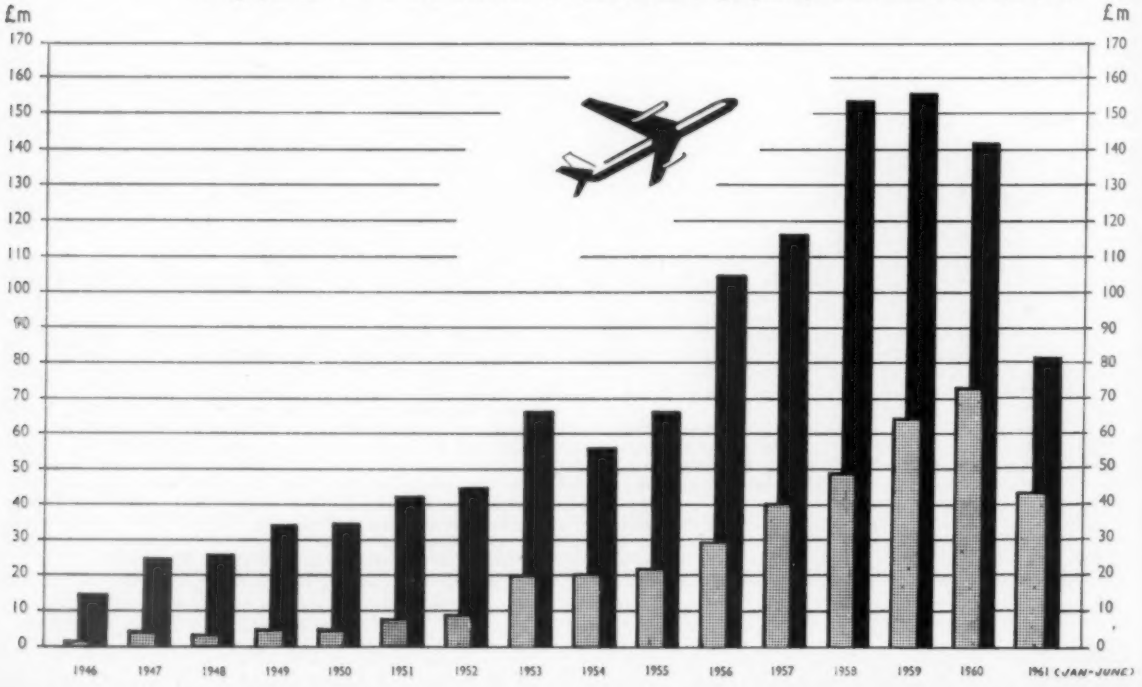
The total of £95,016,650 was made up as follows: aircraft and parts, £39,951,809; engines and parts, £50,763,269 (a record figure); electrical equipment, £2,129,220; instruments, £1,611,204; tyres, £561,148. Leading customers were Canada, which spent £13,400,944 on aircraft and £11,245,726 on engines; and the United States, with £4,621,402 on aircraft and £9,886,789 on engines.

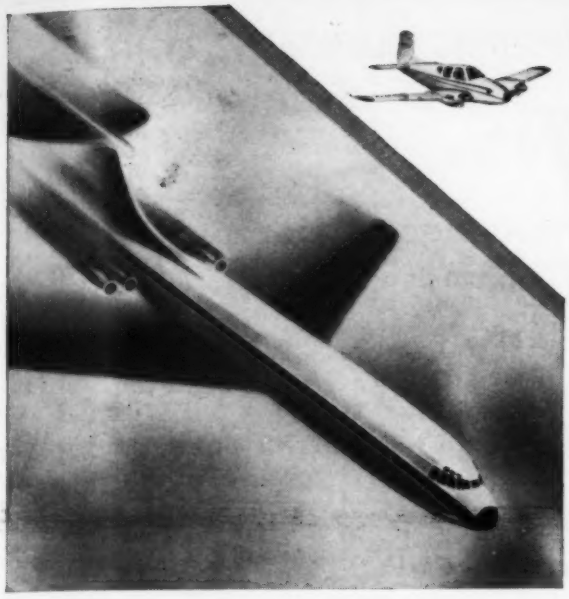
The July exports figure was £12,207,312, made up as follows: aircraft and parts, £5,207,485; engines and parts, £6,334,079; instruments, £304,140; electrical equipment, £302,307; tyres, £59,301.

Year	Complete Aircraft, and Parts (excluding those separately classified)	Electrical Equipment*	Tyres†	Instruments	Engines	Total
1946	12,743,225	—	—	85,394	1,876,067	14,704,686
1947	20,910,770	—	95,297	76,291	4,040,431	25,122,789
1948	22,572,293	—	183,210	138,434	3,237,943	26,131,880
1949	28,989,965	—	238,511	158,736	4,976,830	34,364,042
1950	28,723,828	—	298,516	261,474	5,271,624	34,555,442
1951	33,584,393	—	441,282	341,705	8,022,960	42,390,340
1952	35,271,167	—	522,515	664,739	8,723,272	45,181,693
1953	42,275,545	1,934,289	422,041	1,172,731	20,336,943	66,141,549
1954	31,402,998	2,084,749	610,666	1,151,940	20,859,521	56,109,874
1955	39,654,386	2,259,902	648,293	1,367,419	22,277,022	66,207,022
1956	71,769,410	2,651,056	687,515	1,428,657	28,001,139	104,537,777
1957	69,779,048	3,277,242	810,668	1,979,867	40,596,236	116,443,061
1958	98,539,800	3,296,857	624,657	2,081,925	49,557,723	154,100,962
1959	84,334,923	3,812,253	806,139	2,596,770	64,505,981	156,056,066
1960	61,754,641	3,448,938	915,147	2,517,768	73,687,055	142,323,594
1961 (Jan.-June)	34,722,532	1,825,457	501,847	1,317,324	44,499,462	82,866,622‡

* Until 1953, electrical equipment was included in "Aircraft and parts" totals. † 1953 figure was included in "Aircraft and parts" total. ‡ All 1961 figures, including those in the graph below, are for the January-June period only.

British aviation exports, 1946 to June 1961: the solid columns represent total figures in all categories, and the half-tone columns those in the engine category alone. Grand total since 1946 is £1,167,244,178, including engine exports to the value of £400,436,953





Ekco transistorised airborne Weather Radar systems are designed for all types of modern aircraft

STANDARD The standard Type E190 radar, as supplied or scheduled for many of the world's latest airliners, consists of a scanner, transmitter/receiver and indicator and weighs under 60 lb.

LIGHTWEIGHT By using a new, lighter scanner, we have reduced the weight to 46 lb. which makes the equipment suitable for installation in smaller executive and private aircraft.

DUPLICATE The Ekco Duplicate System has a total weight of only 103 lb.—less than half that of other single systems. It provides full 'fail-safe' conditions, either transmitter/receiver unit operating with either indicator unit.

To simplify servicing, the basic electronic units are common to all systems.

See the Ekco Weather Radar Systems on our Stand 193/194 at Farnborough, together with Automatic VHF/DF Equipment and Transistor Inverters.

EKCO

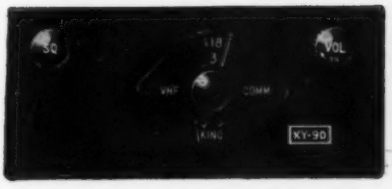
ahead in electronics for aviation

EKCO ELECTRONICS LTD • SOUTHEND-ON-SEA • ESSEX • TELEPHONE SOUTHEND 49491

WPS-376

KING

Class 1 approval granted to the first of the famous King Radio range



KY 90E TRANSCEIVER. 91 CHANNELS. 100 Kc Spacing (117.9—126.9 Mc) Crystal Controlled. 10 watts Transmit Power with Receiver Sensitivity to match. Weighs less than 8 lbs.—3.8 Kg including Power Supply.

U.K. List Price 14 Volt £370 28 Volt £410

CHEAP – LIGHT – AND POWERFUL

Immediately available from

AIRWORK SERVICES LTD
Bournemouth (Hurn) Airport, Christchurch, Hants
Tel: Christchurch 2732

VIGORS AVIATION LTD
Oxford Airport, Kidlington, Oxford
Tel: Kidlington 3444

80

HONG KONG AIRCRAFT ENGINEERING COMPANY LIMITED

17

WE HAVE OVERHAULED
MORE THAN 17 DIFFERENT
TYPES OF AIRCRAFT

WE OVERHAUL AIRCRAFT ENGINES AND
ACCESSORIES FOR 17 DIFFERENT COUNTRIES

WE SERVE MORE THAN 17 DIFFERENT INTERNATIONAL
AIRLINES IN HONG KONG

WE ARE AT YOUR SERVICE

HONG KONG AIRCRAFT ENGINEERING COMPANY LIMITED

Telegrams: AIRENG KAI TAK AIRPORT, HONG KONG Telephone: 820201

European Agents: KILLICK MARTIN & CO. LTD., 20 MARK LANE, LONDON, E.C.3. Telephone: MIN 3100. Telex: London 28424

The AIRCRAFT PACKERS AND SHIPPERS

For over 30 years we have specialised in aircraft packing and there is no substitute for experience. Our extensive premises at Chiswick embody modern handling methods and facilities for grouping, and have long been a focal point for the shipment of aircraft and ancillary equipment for the Industry. Ground equipment, power plants, tugs, trolleys, radomes, canopies, fire-fighting appliances, parachutes, instruments and radio equipment emanating from all the principal manufacturers throughout the country are routed so that the well-proved service of R. & J. Park Ltd. can pack and ship to all parts of the world.

R. & J. PARK LTD.
EXPORT PACKERS
of EXPERIENCE

Registered Office, and Packing Works: DOMINION HOUSE, THAMES ROAD, LONDON, W.4

See us at Stand 246, S.B.A.C. Exhibition, Farnborough—Sept 4-10

Telephone: Chiswick 7761 Cables: "Parkdomin, Chisb"

APPROVED A.I.D., I.F.V., I.E.M.E., C.I.E., ADMIRALTY

CAMLOC

FASTENERS

- open and close quickly with a quarter-turn
- fasten securely
- have no loose parts
- are quickly and easily installed

2600 Series, one of more than 20 different types

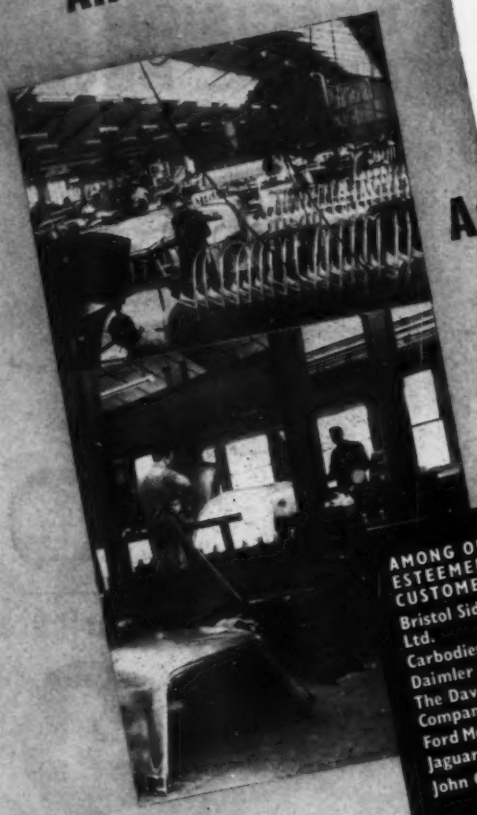
All over the world designers of aircraft, missiles, electronic equipment, and industrial apparatus value the outstanding features of Camloc fasteners. Write for catalogue No. E 61 and see for yourself which Camloc fastener can best solve your particular fastening problem.

(Technical Service in Great Britain)

CAMLOC
FASTENER
GMBH
Frankfurter Strasse 36
Kelkheim/Taunus-Germany
Phone: 288

An Arsenal of Engineering Machinery

INCLUDING
Power presses up to 500 tons. Stretch forming presses. "Cecostamp" drop hammers.
Welding—seam, stitch, spot, argon etc.



An Army of Skilled Engineers

INCLUDING
Craftsmen in sheet metal manipulation; skilled tool makers and fully approved inspection staffs.

A.I.D.
A.R.B. and
C.I.A.
APPROVED

AMONG OUR MANY ESTEEMED CUSTOMERS
Bristol Siddeley Engines Ltd.
Carbodies Ltd.
Daimler Company Ltd.
The David Brown Companies.
Ford Motor Company Ltd.
Jaguar Cars Ltd.
John Curran Limited
The Plessey Company Ltd.
Rover Company Ltd.

& a Chest Full of Medals for jobs well done

FOR DESIGN PROTOTYPE & PRODUCTION WORK, CONTACT—

We Shape the things to come!

The Abbey Panel & Sheet Metal Co. Ltd.

BAYTON ROAD, EXHALL, NR. COVENTRY. TEL: BEDWORTH 2071 (P.B.X)

ENV

The photograph shows the "re-entrant" spiral bevel wheel and hollow pinion used for the Westland Wessex main rotor drive. Both elements have profile ground gear teeth.

SPECIALISE IN PRECISION SPIRAL BEVEL GEARS FOR HELICOPTER DRIVES

Stand 272 S.B.A.C. Show

ENV gears are used on all British and leading continental helicopters with shaft drive.

E.N.V. ENGINEERING CO. LTD, HYTHE ROAD, WILLESDEN, LONDON, N.W.10. Tel: LADbroke 3622

Today's best value in heavy gauge **STEEL SHELVING**

£3·15·0
DELIVERED FREE!

Brand new — Manufactured in our works.
Shelves adjustable every inch.
Heavy gauge shelves will carry 400 lb. each.
Stove enamelled dark green.
6 shelves per bay—Extra shelves 8/- each.
Quantity discounts.

THE ONLY HEAVY GAUGE SHELVING AT THIS PRICE

Other sizes available. Also available in white at £5 per bay.

N.C. BROWN LTD
AERO WING, HEYWOOD, LANCS. Tel. 69018 (6 Lines)

insulate—preserve—lubricate
with the **NEW**
AMBERSIL MS 4

Multi-Purpose
Silicone Grease
AEROSOL SPRAY

In electrical and electronic equipment in aircraft ingress of moisture, corrosion and oxidation are primary causes of breakdown and high maintenance costs. The introduction of AMBERSIL MS 4 Aerosol Spray provides an "easy to apply" non-melting silicone grease with excellent dielectric properties and a working temperature range of −50°C to +200°C for waterproofing, insulating, lubricating and preserving electrical and electronic equipment. One pass from the handy 12oz. aerosol gives an uncontaminated film, even in inaccessible areas, ensuring complete protection with economy and simplicity in application.

Write or 'phone for full information to:

AMBER OILS LIMITED, 11a, Albemarle St., London, W.1. MAYfair 0161/3

this aircraft is 100 miles long

100 miles long, 10 miles wide and 1,000 feet deep, in fact . . . because rigid safety regulations say that ten minutes flying time, ten miles of lateral space and one thousand feet of vertical space shall separate all aircraft all the time they are using the air lanes. Now, mutiply the *number* of aircraft that are flying . . . magnify their size . . . increase their speeds . . . and the problem of separation becomes difficult indeed. Obviously, accurate instrumentation, advanced electronics and even more advanced navigational aids are of paramount importance. In these three directions alone, Ferranti are making significant contributions to Britain's progress in the air.

FERRANTI

First into the Future

Airpass Radar Fire Control Systems; Gyroscopes; Transistorised control units; Artificial horizons; Missile Guidance and Control Systems; Inertial navigation systems; Machine tool control systems; Silicon semi-conductor devices for controls; Power supplies; Instruments and Radar; Electronic computers and systems.

FERRANTI LTD. HEAD OFFICE: HOLLINWOOD, LANCS. LONDON OFFICE: KERN HOUSE, 36 KINGSWAY, LONDON, W.C.2.

FG 338

We at Bell's

always enjoy the opportunity given by the S.B.A.C. Show not only to meet old friends and make new ones, but to show off the full range of "Bestobell" Aviation products.

See them ON STAND NO. 36
SBAC SHOW FARNBOROUGH 1961

Flexible Connectors and Bellows for cabin air-conditioning and de-icing systems.
Asbestos Fire Seals, Insulation, Silicone and Synthetic Rubber products.
Flexible hoses for airborne and ground equipment including air-starting and air-conditioning hoses.

BELL'S ASBESTOS AND ENGINEERING LIMITED
Aircraft Division, Bestobell Works, Slough, Bucks. *Telephone:* Slough 23921

As supplied to Rolls-Royce Ltd., Bristol Siddeley Engines Ltd., de Havilland Engine Co., Burnley Aircraft Ltd., Joseph Lucas Ltd., D. Napier & Son Ltd. and Sperry Gyroscope Ltd., for Avon, Conway, Dart, Eland, Gnome, Gyron, Mamba, Olympus, Orpheus, Proteus, Sapphire, Tyne and Viper etc.

EQUATOR WHEELS & SECTIONS LTD.
RAGLAN STREET WOLVERHAMPTON
GRAMS: "SECTIONS" Tel.: 21605/6
A.I.D. Ref. No. 40297 & A.R.B. Approved
Specialists in Cold Rolling, Forming and Coiling for the Aircraft Trade

EASTERN AERO
ELECTRICAL SERVICES LTD
WORKS AND SERVICING DEPT.
Priory Street, Colchester *Tel. Colchester 6173*

SALES DEPT.
London Airport
Tel. SKYPORT 1314

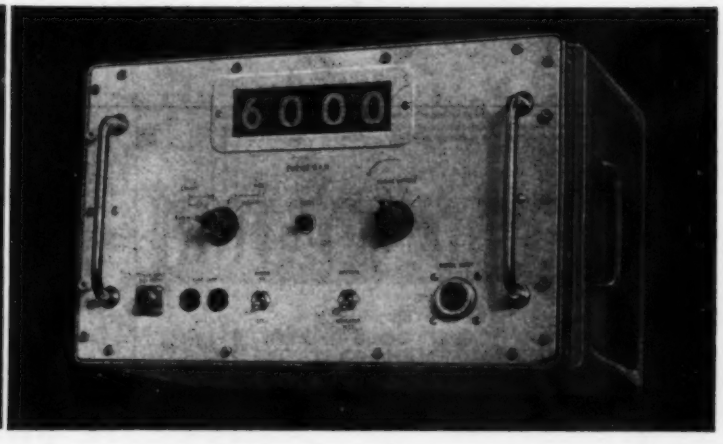
AUTHORISED SALES AND SERVICE STATION FOR
AEI
AIRCRAFT EQUIPMENT GROUP

We specialise in the supply and repair of Aircraft Electrical Equipment for BRITANNIA · COMET VISCOUNT · VANGUARD

The RACAL JET ENGINE SPEED TACHOMETER

sets new high accuracy in jet engine testing

ensuring maximum power



On view at the BAKELITE Stand (No. 24) at SBAC Show, Farnborough

The **SA509** provides accurate indication of engine efficiency without periodic dismantling and examination.

Note these features:—

- Cuts down routine inspection time
- Portable, self-contained unit working from aircraft supply; weight 35 lb.
- Enables setting of engine to give maximum power
- Accurate readings in a few seconds
- Adaptable to any jet engine
- All printed circuits are based on copper clad Bakelite laminate

Full details and specifications available on request.

RACAL INSTRUMENTS LIMITED

BRACKNELL · BERKSHIRE · ENGLAND · Tel: Bracknell 941 · Grams/Cables: RACAL BRACKNELL

SOMETHING NEW...

from the THERMAL CONTROL FILTRATION LABORATORIES

A MILLIMICRON UNIT FOR THE CRITICAL FILTRATION OF SYSTEM FLUIDS

The Filter when operating with non-polar fluids has efficiencies of 99% down to 1 micron and 80% for particles below 1 micron at rated flow.

The filter has a three-stage element, two stages being in sintered stainless steel wire and an intermediate stage of aluminised borosilicate. The stainless steel media is permanent and the borosilicate media disposable. The unit is easily and cheaply serviced by the user at the point of operation, eliminating servicing by the filter manufacturer and the need for costly replacement elements.

Units are currently available for flow rates of 60, 180, 300, 600, 1,500, and 2,100 I.G.P.H. at working pressures up to 4,000 p.s.i. and temperatures up to 230°C. At a differential pressure of 50 p.s.i. for fluid having a viscosity of 20c/s at relative temperature.

THERMAL CONTROL CO. LTD.
FILTRATION LABORATORIES, SACKVILLE RD, HOVE, SUSSEX
Telephone: HOVE 35929

SCOTTISH AVIATION

for . . .

AIRCRAFT AND COMPONENT DESIGN AND MANUFACTURE

• • •

AIRCRAFT OVERHAUL, CONVERSION AND MODIFICATION

• • •

PRATT AND WHITNEY R1830 ENGINE AND ACCESSORY OVERHAUL

• • •

PROPELLER OVERHAUL

Send your enquiries to

SCOTTISH AVIATION LTD

PRESTWICK AIRPORT · AYRSHIRE

Phone:
PRESTWICK 79888
(20 lines)
TELEX: 77432

Cables:
AERONAUTICS
PRESTWICK

WINGS DAY
SEPT. 16th
GIVE FOR THOSE WHO GAVE

We manufacture

HIGH GRADE SPECIAL PURPOSE RELAYS TO CUSTOMERS' OWN REQUIREMENTS

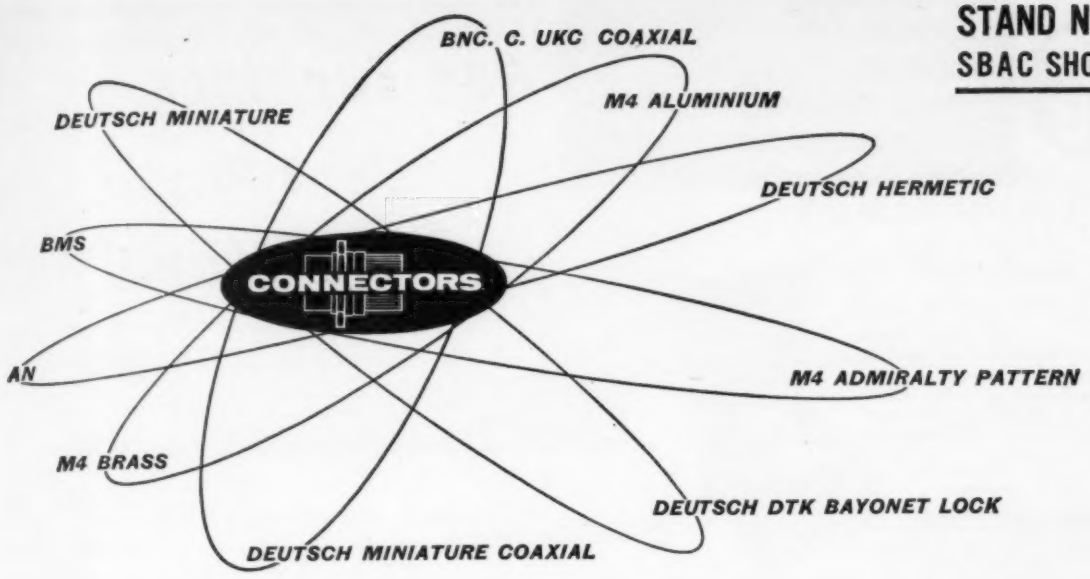
PLUGS, SOCKETS
WIRING FORMS
CONNECTOR SETS
SBAC WIRING SYSTEM
SINGLE POLE AND DOUBLE POLE SWITCHES, ALSO ADMIRALTY PATTERN SAFETY SWITCHES
ADMIRALTY PATTERN KEY SWITCHES

E.I.D. AND A.R.B. APPROVED

C.W.C. EQUIPMENT LTD.

ACORN WORKS, KINGS GROVE, MAIDENHEAD, BERKS.
MANUFACTURING ELECTRICAL ENGINEERS
TELEPHONE: MAIDENHEAD 2275-6-7
Illustrated Catalogues available on request

STAND N° 181
SBAC SHOW



S:B
SMART AND BROWN (MACHINE TOOLS) LTD.
25 MANCHESTER SQUARE LONDON W.1.
Tel: WELbeck 7941
Member of the Gas Purification Group

IMPORTANT TO STRESS

Heli-Coil is used on five continents in aircraft construction. These designers with look-ahead ideas specify Heli-Coil Inserts for their design facility. Heli-Coil Screw Thread Inserts are manufactured in high tensile stainless steel wire and replace traditional threads. They combine lightness, strength and economy.

Once fitted, Heli-Coil Inserts will withstand higher load strains and stresses than conventional threads. They will expand and contract with the parent material. Shorter, less bulky thread engagements are possible. Heli-Coil Screw Thread Inserts can give considerable saving in material, time and labour because they permit component redesign for thinness with increased strength. They are assembled and disassembled with remarkable ease.

HELI-COIL*
SCREW THREAD INSERTS

**Heli-Coil is a registered trade mark*

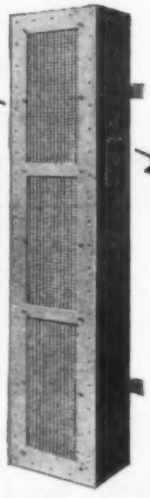
INCREASED STRENGTH
—REDUCED WEIGHT

Write for further details to ARMSTRONG PATENTS COMPANY LIMITED **EASTGATE, BEVERLEY, YORKS. Tel: BEVERLEY 82212 (10 Lines)**

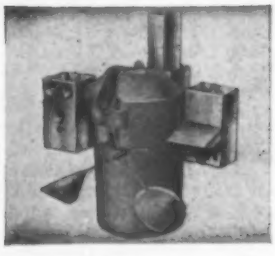
Manufacturers of

ELECTRICAL COMPONENTS
COMMUNICATIONS EQUIPMENT
METEOROLOGICAL EQUIPMENT
PLASTIC MOULDINGS

P.O. TESTER SA.9116
This tester is primarily designed for the measurement of cable sheath potentials. It operates as a potentiometer type voltmeter for measuring potentials up to 1.0 volts and as a direct reading voltmeter for potentials up to 10 volts.



LINE SOURCE RADIATOR
This Line Source Radiator Loudspeaker unit consists of six 10" loudspeaker units and associated matching equipment mounted in a metal cabinet.



RADIO SONDE TRANSMITTER
Supplied to British Meteorological Office and foreign governments.

COCKPIT CONTROL KNOBS
Each knob has been designed with a distinctive shape so that it is instantly recognisable by touch.

AS EXHIBITED AT THE S.B.A.C. SHOW

WHITELEY ELECTRICAL RADIO CO. LIMITED
MANSFIELD · NOTTS

WB 162

Gas Turbines and Jet Propulsion

G. GEOFFREY SMITH, M.B.E.

Revised and enlarged by F. C. Sheffield

This book has been generally recognised as the standard work in its field since it was first published in 1942. Edition by edition the book has necessarily been enlarged, and this edition covers in a most comprehensive manner the entire subject of the gas turbine as applied in aviation today. The fundamentals and history of jet propulsion are explained, and all its main technical aspects dealt with. An exhaustive review of modern British, American, Canadian and European gas turbines is given, and there is much up-to-date information on ramjets, pulsejets, rockets, and the use of the gas turbine for road transport, marine and industrial purposes.

6th Edition. **35s. net.** *by post 36s. 9d.*

●

Some Press Opinions

"... valuable to all interested in gas turbines, for any purpose." *Scientific Lubrication*

"As a work for general interest and detailed practical knowledge this book earns the highest praise." *The Halton Magazine*

"... should find a place on every technical bookshelf." *Interavia (Switzerland)*

"The book retains its position as an authoritative account of early development and subsequent progress." *Nickel Bulletin*

"This is literally the standard reference work on this important topical subject and should not be missed." *Motor Sport*

"Anyone interested in 'Jets' will want this book and find it extremely interesting and useful." *Technical Book Review*

From leading booksellers

Published by

ILIFFE Books Ltd Dorset House Stamford St London SE1

MALLITE

GALLEY EQUIPMENT

Meal Tray Boxes,
Bar Boxes
Equipment Boxes

Lighter, Cleaner, Stronger and more rigid

Stand No 107

William Mallinson and Sons Ltd.

130 HACKNEY ROAD · LONDON · E.2

Telegrams 'Almoner' London

MEAL BOX, Type 1/108
(weight 10¼ lb.)

Designed to take 6 or 8 trays of 11" width and to fit a galley installation measuring 11¼" x 17 3/16" x 18¼". Constructed from MALLITE EGB.4. which has given many years of service as an aircraft floor taking direct seat loads.

MANUFACTURERS OF PLYWOOD · ARMOURPLY · PANELS AND AIRCRAFT LAMINATES

TECHNICAL PLATINGS LTD

OF

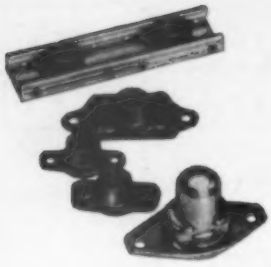
Teddington, Middlesex

SINCE 1931 WE HAVE SPECIALISED IN MEETING THE DEMANDS OF THE AIRCRAFT INDUSTRY

MAY WE ASSIST YOU IN YOUR METAL FINISHING PROBLEMS?

Anodising, Chromic and Sulphic · Heavy Deposition · Paint Spraying
Precious Metal Deposition · Material Testing, etc.

Telephone: TEDDINGTON LOCK 4381-4



Leading aircraft manufacturers take advantage of weight and space saving by fitting KAYLOCK parts.

The following are among those who specify KAYLOCK:

BLACKBURN AIRCRAFT
BRISTOL AIRCRAFT
DE HAVILLAND AIRCRAFT
HANDLEY PAGE
HUNTING AIRCRAFT
A. V. ROE
WESTLAND (SAUNDERS-ROE)
SHORT BROS. & HARLAND
VICKERS-ARMSTRONGS (AIRCRAFT)

KAYLOCK

Lightweight all metal

SELF LOCKING NUTS

SAVE UP TO 80% DIRECT NUT WEIGHT

Sole Concessionaires for the United Kingdom

C. J. FOX & SONS (AVIATION) LTD.
117 VICTORIA STREET, LONDON, S.W.1. *Victoria 0204/5*

June in January...

WHEN YOU'RE PROPERLY EQUIPPED!

On the screen—or handsomely enlarged—your summer pictures will look so much more vivid. Here in the Enlarger and Projector Number of AMATEUR PHOTOGRAPHER are full details, illustrations, and prices of the equipment you need—covering the complete amateur range of enlargers and projectors on the market, plus screens, enlarging lenses, masking frames, even the specialists's episcopes and stereoprojectors. Here too is expert advice to help you choose. Make sure of this invaluable guide.

ALL NEWSAGENTS 1s 3d

Amateur PHOTOGRAPHER

ENLARGER & PROJECTOR GUIDE · *OUT NOW*

NEW ML DEVELOPMENTS SEEN AT Stand 41

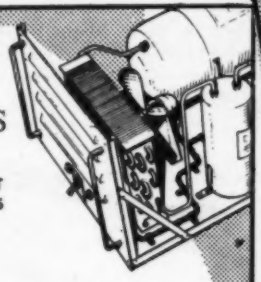
S.B.A.C. EXHIBITION

Farnborough

ML Static seat

An entirely new static seat which enables crew members of an aircraft to quit the seat when fully equipped and subjected to g forces. An inflatable seat cushion raises both the occupant and the combined pack by air inflation from a 1200 p.s.i. bottle incorporated in the seat. A new parachute pack combines G.Q. chute, survival pack and emergency oxygen in one envelope.

M.L. MINIATURE REFRIGERATORS



FOR ALL ELECTRONIC EQUIPMENT
- RADAR, MISSILES, SIMULATORS
- ALSO SMALL MECHANISMS

HEAT DISPERSAL CAPACITY 2 kW.
DIMENSIONS 8 in. x 6 in. x 24 in.

FITS STANDARD POST OFFICE RACKS

Power Jettison Equipment
Airborne Releases
Aircraft Loading and Missile Handling Equipment
Air Conditioning and Pressure Test Vehicles
Electrical Test Units
Aircrew Helmets and A.E.A.
Armaments

ML AVIATION COMPANY
A.I.D. & A.R.B. APPROVED

WHITE WALTHAM AERODROME, MAIDENHEAD, BERKS. Tel: Littlewick Green 248 Grams: "EMELAIR," White Waltham.

WARD BROOKE & CO LTD

HIGH WYCOMBE, BUCKS.

Tel: High Wycombe 4531

Sole Manufacturers and Licensees

"VICKERSTRIP"

TERMINAL BLOCKS

Details sent on request

AIRCRAFT ELECTRICAL COMPONENTS

HIGH TEMPERATURE TERMINAL BLOCKS AND FUSE CARRIERS

FLEXIBLE NYLON DUCTING AND CONDUIT

NYLON LAYFLAT TUBING, CABLE MARKERS AND STRAPS ETC.

S.B.A.C. SHOW STAND 252

R.L.A.
GUARANTEED
LAMINATED ALUMINIUM
Spec.: D.T.D. 900/4526

D.G.I. Ministry of Aviation Approved. A.R.B. etc.

FINEST FORM OF ACCURATE ADJUSTMENT WITH ·002" OR ·003" LAMINATIONS SHEETS OR COMPONENTS

FITTED TO ALL IMPORTANT AIRCRAFT INCLUDING—COMET, VISCOUNT, VANGUARD, V.C.10, TRIDENT, BRITANNIA, ETC.

WRITE FOR SAMPLES
ALUMINIUM — BRASS — STEEL

SO SIMPLE TO PEEL

S.B.A.C. EXHIBITION STAND No. 98

B. ATTEWELL & SONS LIMITED
Sole Distributors
Makers of Aircraft Components for over 20 years
Phone: Iver 1102-3-4 IVER, BUCKINGHAMSHIRE Grams: "Reflection-Iver"

FOKKER—THE MAN AND THE AIRCRAFT
BY HENRI HEGENER

NOW ON SALE
ORDER YOUR COPY NOW

Over 100,000 words, 400 photographs, 49 $\frac{1}{72}$ scale 3-view tone paintings, over 200 Fokker types reviewed. Here, in one 224-page volume, is told the whole story of Fokker's youth and early experiments; his rapid rise to fame during the 1914-1918 war when he designed and produced for the German Air Service; his removal to Holland after that war and establishment of his firm in the country of his birth; the world-wide use of his aircraft in the inauguration and development of international air lines; his entry into the American aircraft industry, and the story of the Fokker firm to date.

Size is 8½" × 11½", 224 pages cloth bound, weight is 2½ lb., price 45/-. Write to Dept. FT/FO for illustrated leaflet describing fully contents of this book.

HARLEYFORD PUBLICATIONS LTD.
LETCHWORTH, HERTFORDSHIRE, ENGLAND

THE
ACE HIGH HAND TOOLS

Ring Wrenches, Open Jaw Wrenches, Torque Wrenches, Ratchet Wrenches, Socket Wrenches and Sets.

OVER 2,500 DIFFERENT TOOLS
English, American, Unified and Metric Sizes.

TOOL UP WITH BRITOOL
CHROME ALLOY STEEL SERVICE TOOLS

Manufactured at
BRITOOL WORKS, BUSHBURY, WOLVERHAMPTON, ENGLAND.

A member of the group of companies

MILLER AVIATION
LIMITED
ADASTRAL HOUSE · NUTFIELD · REDHILL · SURREY
Tel: REDHILL 5050 (10 lines) Cables-Telex-21433-SASCO-REDHILL

J. J. BENSON

AIRCRAFT INTERIOR FURNISHING LTD

Complete or part interiors and seating to your requirements

SOUTHEND AIRPORT SOUTHEND-ON-SEA ESSEX

Tel. SOUTHEND-ON-SEA 544603

—RAPP TO THE RESCUE

Almost every British-built aircraft in the skies today is to some extent made from **ALUMINIUM** and **STEEL** supplied by the **RAPP GROUP** from Britain's largest stock of **A.I.D./A.R.B. SHEET, STRIP, BAR, TUBE, Etc.**

Bring your raw material problems—urgent or long term to:

LEO RAPP LTD./LR AIRSTEEL LTD./LEO RAPP (Steel) LTD.

WIMBORNE AVENUE, NORWOOD GREEN, SOUTHALL, MIDDLESEX

Telephone: SOUthall 2322 (20 lines) Telex No. 25172

ONE OF THE AUTOMOTIVE PRODUCTS GROUP

AUTOMOTIVE PRODUCTS COMPANY LTD., Leamington Spa, Warwickshire

REGD. TRADE MARK 'PUROLATOR'

SENIOR PERFORMANCE ENGINEER

Guided Weapons Department

of

SHORTS

Required for Performance and Aerodynamic Assessment of current and future Guided Weapons Projects.

Candidate must possess a Degree in Aeronautical Engineering or its equivalent, though a good degree in Physics or Mathematics will be acceptable.

At least five years' experience in the Missile or Aircraft Industry is necessary.

The appointment carries monthly or executive status, depending on suitability of candidate.

The Company operates a Superannuation Fund with which is associated free Life Insurance.

Assistance with housing and with expenses of removal is available to selected married candidates from Great Britain.

Application should be made to the:

Staff Appointments Officer

SHORT BROTHERS & HARLAND LIMITED

P.O. Box 241

Belfast 3

QUOTING S.A. : 715

AERO CONTROLS LTD

DESIGN AND MANUFACTURE OF . . .

- FLYING CONTROL SYSTEMS
- UNIVERSAL JOINTS
- STEADY BEARINGS
- S.B.A.C. STANDARD PARTS
- COWLING FASTENERS
- ACFLEX FUEL SYSTEMS COUPLINGS
- QUICK RELEASE COUPLINGS
- BASIX GROUND EQUIPMENT
- TELESCOPIC LADDERS

AERO CONTROLS LIMITED

Industrial Estate, Weedon Road, Northampton Telephone: 33131/5

A. J. WALTER

(AVIATION) LTD

C47A, C47B, DC3, DAKOTA SPARES

PRATT AND WHITNEY ENGINE SPARES

AIRCRAFT INSTRUMENTS AND GYRO PILOT UNITS OF ALL TYPES

EXTENSIVE RANGE OF AN HARDWARE FOR ALL TYPES OF AMERICAN AIRCRAFT FROM PIPER 'CUB' TO DC.6

Write, call, cable or telephone

A. J. WALTER (AVIATION) LTD

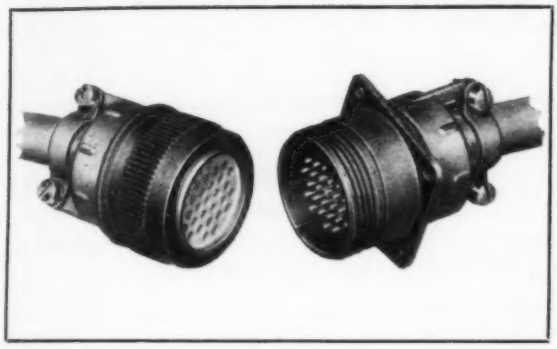
THE DRIVE · HORLEY · SURREY

Telephone:- HORLEY 1420
HORLEY 4294

Cables:- "CUBENG" HORLEY

GIVE GENEROUSLY
R.A.F. BENEVOLENT FUND 67 PORTLAND PLACE LONDON, W.1.

A new range of miniature multi-contact connectors, environmentally sealed for continuous high temperature working



AMPHENOL 48 SERIES

This new range is made to the rigorous requirements of MIL-C.26500 in 6 shell sizes with 10 contact combinations and with removable, crimp-type contacts. The silicone rubber dielectric is proof against lubricating oil, and hydraulic fluids to the appropriate U.S. MIL specifications.

Write for full information and details of other types

See the Amphenol range on Stand 289 S.B.A.C. Exhibition Farnborough

AMPHENOL BORG

AMPHENOL-BORG LIMITED

Amphenol Electronics Division, Victoria Road, Burgess Hill, Sussex
Telephone: Burgess Hill 85616 (3 lines) *Telegrams: Amphenol, Burgess Hill.*

AMPHENOL-BORG ELECTRONICS CORP., CHICAGO, U.S.A.
AMPHENOL CANADA LTD., TORONTO 9, ONTARIO

TO

SENIOR AERODYNAMICISTS

who are interested in work on V/STOL, on boundary layer control, on developments stemming from full scale jet lift experiments, and on the performance stability and control studies of new projects as part of a generally expanding aerodynamic programme, and who have either a D.C.Ae., a suitable degree or a H.N.C. supported by relevant experience.

SHORTS

can offer appointments of a remunerative nature with considerable future opportunity.

SHORTS will consider carefully any preference expressed by applicants in these fields.

Many of the problems are new and require original and inventive thinking.

The appointments will be to the monthly staff.

Assistance is available with housing and with removal expenses to selected married candidates from Great Britain.

The Company operates a Superannuation Fund with which is associated free Life Insurance.

Interviews can, if desired, be arranged either in London or Belfast.

Application, giving details of background and qualifications, should be made to the:

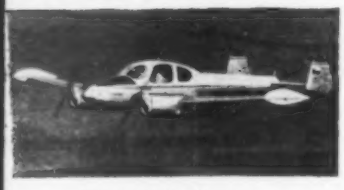
Staff Appointments Officer,
SHORT BROTHERS & HARLAND LIMITED,
P.O. Box 241,
Belfast, 3
Quoting S.A.716.

Fascinating Flying

in the latest 'Continentals'

The elegant Meta-Sokol

The superb twin engine Aero 145



The magic Morava

- Fuel Injection for economy and safety
- Variable Pitch Propellers
- Retractable undercarriage (Hydraulic operated Tricycle on the Morava)
- Comfortable 4 seat cabin (5 seats in the Morava) with exceptional all round view
- Comprehensive Standard Equipment
- Full spares backing

For full information for these aircraft and the famous ZLINN trainers write or telephone

SOLE U.K. AGENTS **Peter S. Clifford & Co. Ltd.,**
Oxford Airport, Kidlington, Oxford

Telephone Kidlington 3355 — Evening and Weekends Bletchington 392
In conjunction with G/C Edward Mole, U.K. Distributor

World Export enquiries **OMNIPOL LTD** WASHINGTONOVA II Prague 3 Czechoslovakia

WESTAIR FLYING SERVICES

Authorised Dealer for the North and Midlands

SALES • SERVICE • PARTS
CHARTER • LINK TRAINING

Cessna for '61

"Flight" photograph
CESSNA 172

Cessna Aircraft available now at Blackpool. Demonstrations arranged

Call or telephone:

SQUIRES GATE AIRPORT
BLACKPOOL
TELEPHONE 42660 and 43061-12
ESTABLISHED SINCE 1937

CONTROL ENGINEERING

Manufacturers of precision controls invite applications for the following *Senior* vacancies in their Engineering Department.

DESIGN ENGINEERS

to initiate original Design concepts and supervise preparation of Design Studies and specifications after liaison with customers.

DEVELOPMENT ENGINEERS

to carry out Research and Development work on various projects and supervise preparation of Test Schedules and Reports, including the design of special Rigs and Structures.

The work covers a wide range of Aircraft, Nuclear and Industrial projects including Electro-Hydraulic Servo-Mechanisms, Remote Handling Devices as well as Pneumatic and Hydraulic Systems for Power Transmissions and Automatic Machinery.

The posts, carrying Monthly Staff status, offer good prospects of a permanent and progressive career. Initial salaries will be dependent upon qualifications and experience. Travelling and other expenses will be paid to those invited to interview. Assistance will be given with removal expenses.

Those interested are asked to write in the first instance giving details of age, education and experience to:

H. M. HOBSON LIMITED
FORDHOUSES, WOLVERHAMPTON, STAFFS.

FLIGHT
Aircraft, Spacecraft, Missiles

PRESS DAY — *Classified advertisement "copy" should reach Head Office by* FIRST POST THURSDAY *for publication in the following week's issue subject to space being available.*

CLASSIFIED ADVERTISEMENTS

Advertisement Rates. 1/2 per word, minimum 14/-. Special rates for Auctions, Contracts, Patents, Legal and Official Notices, Public Announcements, Public Appointments, Tenders 1/4 per word, minimum 16/-. Each Paragraph is charged separately, name and address must be counted. All advertisements must be strictly prepaid and should be addressed to FLIGHT Classified Advertisements Dept., Dorset House, Stamford Street, London, S.E.1.

Postal Orders and cheques sent in payment for advertisements should be made payable to "Flight," and crossed & Co.

Trade Advertisers who use these columns regularly are allowed a discount of 5% for 13, 10% for 26 and 15% for 52 consecutive insertion orders. Full particulars will be sent on application.

Box Numbers. For the convenience of private advertisers, Box Number facilities are available at an additional charge for 2 words plus 1/- extra to defray the cost of registration and postage, which must be added to the advertisement charge. Replies should be addressed to "Box 0000, c/o Flight," Dorset House, Stamford Street, London, S.E.1.

The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

AIRCRAFT FOR SALE

GRANTAIR LTD.
GRANTCHESTER
CAMBRIDGE
Telephone: Trumpington 3132 (24 hours per day)

YOU have a licence—we have aircraft. Recent C. of A. (Private or Hire and Reward), H.P. or leasing. British or American. Two, four or more seats. With or without radio, £1,000 to £10,000. Demonstrations anywhere, any time. Hire one for a week before you buy it. [0233

D.H. CHIPMUNK Mk22, full dual 10 channel radio, night flying, electric starter, nil hour engine, full aerobatic C. of A., etc., £3,000.

A. J. WHITTEMORE (AERADIO) LTD., Biggin Hill, Kent. Biggin Hill 2211. [0501

PRENTICE, long range tanks. Steel rod motor. Many extras. Seen Newcastle Airport. Offers. Dr. J. McClory, Stamfordham House, Stamfordham Road, Newcastle-on-Tyne. [2349

CESSNA 180, property Whitco, immediately available at Biggin Hill for $12,500, approximately £4,450 including U.K. import duty. Inspection welcomed.—Air Couriers Ltd, Biggin Hill Aerodrome, Kent. [2360

GEMINI GIPSY MAJOR, VHF, ADF, comprehensively equipped. Would part exchange for Auster.—Ratcliff, Widney Cottage, Knowle, Warwickshire. [2371

PRENTICE (7 seater), full blind flying panel, radio, etc., C. of A. expires 1964. Price £1,850.

RAPIDE (9 seater) in flying order, a snip at £400. Yes, four hundred pounds. Box No. 7438. [2384

AUSTER AIGLET J5K Cirrus Major III Engine. 400 hours unexpired, annual C. of A. expires December 1961. Dual control/brakes, starter, generator, full panel, navigation lights, landing light, 32 gallon tanks. £1,675. —48 Glebe Place, Chelsea, S.W.3. [2400

AUSTER V with low hours and 3 year C. of A., with full blind flying panel and many extras, for immediate sale, £1,600 o.n.o.—Send for full specification list to Photopia Ltd., Newcastle, Staffs. [2405

AIRCRAFT ACCESSORIES & ENGINES

H. T. NEWTON AND CO. and NEWTONAIR LIMITED, Gatwick Airport, for all your aircraft electrical and electronic equipment. A.I.D. and A.R.B. [0299

ROLLASON'S for Tiger Moth spares, Gipsy engine overhauls and spares; and now increased facilities at Biggin Hill for your C. of A. overhaul. All light aircraft types acceptable. Croydon 5151. [0133

72 H.P., 75LB, McCullogh flat four, t.t. 8 hours, s.c.o. nil, £135. Also time ex. Cirrus Mi.I, £45. All Taylorcraft spares. Thornbury 2055. [2538

AIRTRADE LTD. for Aircraft and Aero Engine spares. Components and Instruments. A.R.B., Croydon Airport, Surrey. Tel.: CRO 0643. [0232

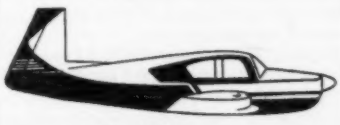
FAIRCHILD Argus engines and airframe complete. Travelair Ltd., 115 Oxford Street, W.1. (Tel.: GER 3382.) [0135

PLUGS and Sockets. More than 1,000,000 in stock covering over 50 different ranges. British and American. Stock list on application to Sasco, Nutfield, Redhill, Surrey. Tel.: Redhill 5050. [0052

GIPSY QUEEN 70/4 ENGINES, n.h.s.o. de Havillands, certified ex. stock—Aerocontacts (Aircraft Distributors) Limited, Gatwick House, Horley, Surrey. Tel.: Horley 4455. Cables Aerocon Horley Telex. [2362

AERONAUTICAL & MARINE SUPPLIES LTD. for all aircraft and engine spares for Dakota, Viking and Dove aircraft. Aeronautical and Marine Supplies Ltd. Southend Airport, Essex. Tel.: Southend 40334/5/6. [0163

R. K. Dundas
AERO LIMITED



MOONEY MK. 21

Sit in the Mooney Mk. 21 and you'll experience the most tastefully appointed interior for any of the single engined retractables on the market, added to which is the most practical pilot planned panel in the business. These facts, coupled with fatigue-free low-noise level, crisp and efficient control, the high cruising speed, all add up to big plane performance and flexibility, at an all-time low operating cost.

For further convincing, come fly our demonstrator, then you'll say
Make mine a Mooney.

Sole U.K. Distributors for Mooney Aircraft:

R. K. DUNDAS AERO LIMITED
Dundas House, 59 St. James's Street, London, S.W.1

HYDe Park 3717. Cables: DUNDUK

The 210
Cessna
APPOINTED DEALERS

The North & West Midlands: Westair Limited, Squires Gate Airport, Blackpool, Lancs.
East Anglia & East Midlands: W. H. & J. Rogers (Engineers) Ltd., Gt. Barford, Bedford.
West: Steels (Aviation) Limited, Clifton, Bristol.
Scotland: Airwork Services Limited, Perth Aerodrome, Perth, Scotland.

SOLE DISTRIBUTORS IN GREAT BRITAIN ARE
AIRWORK SERVICES
PANSHANGER AERODROME • HERTFORD
TELEPHONE: ESSENDON 315

AIRCRAFT ACCESSORIES & ENGINES WANTED

WANTED, pair aerobatic seats for Auster Aiglet Trainer or exchange ordinary type with adjustment. Davey, 18c Pembroke Road, Clifton, Bristol. [2390

GIPSY MAJOR 1 engine wanted. Must be complete and have at least 500 hours to run. Box No. 7463. [2404

AIRCRAFT FOR HIRE

GRANTAIR LTD.
GRANTCHESTER
CAMBRIDGE
Telephone: Trumpington 3132 (24 hours per day)

YOU have a licence—we have aircraft with or without pilot—with or without radio. 2 or 4 seats. Tri-Pacer, Caribbean, Cubs or Austers for hire or lease (free maintenance, insurance and repair). From £2 10s per engine hour without pilot or 1s. 3d. per mile with pilot.
EUROPE, AFRICA or ASIA covered
[0234

AIRCRAFT WANTED

HORNET or Leopard Moth wanted. Must be in good flying condition and reasonable price. Please send full particulars and photograph if possible, to K. H., Eastlands School, Sutton-on-Sea, Lincolnshire. [2380

APACHE or similar aircraft required. Full details and sensible price to Box No. 7468. [2416

AIR PHOTOGRAPHY

MORSE Film Developing Units and Film Driers. Continuous Film Printers, Argon and Mason Contact Printers; Water Supply Kits; Glazing Machines, F24 Spiral and Spool Developing Outfits; K17, K15, K49 and K24 Cameras. Mounts, Lenses, Magazines, Controls, Vacuum Pumps, Motors and Spares for above Cameras: 16mm and 36mm Cameras, Projectors and Spares. Also large quantity of Aerial Film (all sizes). A. W. Young, 47 Mildenhall Road, London, E.5. (Tel.: AMHerst 6521.) [0290

K24, F24, K19B, K17B and most other types of aircraft cameras in stock. Accessories, controls, also available. Developing equipment. Morse printers, test units available from stock.

HARRINGAY PHOTOGRAPHIC SUPPLIES LTD., 423 Green Lanes, London, N.4. Mountview 5241/5. [0810

PLANE PIX. Sets of 116 photographs. List with sample, 1s.—26 Marriot Road, Barnet, Herts. [2421

AIR SERVICING

HANTS & Sussex Aviation Ltd., Portsmouth, have now obtained additional hangar space and can offer facilities for C. of A. overhauls, modifications and all types of repairs. Tel.: Portsmouth 62087. [0467

AVIATION COMPUTERS

KAYS OF EALING. Stockists of Aristo, Jeppesen, Weems, Swissair, R.A.F. Mk. 4, Box Dalton, Computers, Scale Rules, Protractors, etc. Quotations, Mail Order, by return. Write for latest Stock List. 8-10 Bond Street, Ealing, W.5. EAL. 2813. [0244

BALL BEARINGS

NEW Ball and Roller Bearings, over 4,000,000 in stock in more than 4,000 types. Britain's largest stocks. Stock list available. Claude Rye Ltd., 895-921 Fulham Road, London, S.W.6. RENown 6174 (Ext 24). [0420

BINOCULARS

CANADIAN ex-Naval officers' (Bausch and Lomb pattern) 7 × 50 Prismatic eyepiece focusing (cost £60). Limited supply, new with case, £19 17s. 6d. A. W. Young, 47 Mildenhall Road, E.5. Tel.: AMHerst 6521. [0291

BUSINESS OFFERS

TWO VACANCIES exist for P.P.L. holders to take one-sixth share each in private light aircraft. Write now. Box No. 7462. [0421

CAPACITY AVAILABLE

KELLERING and Cam Profiling capacity up to 8ft × 6ft or 6ft diameter.

ARMYTAGE BROS (KNOTTINGLEY) LTD., The Foundry, Knottingley, Yorkshire. Telephone: Knottingley 2743/4. [0238

CARS FOR SALE

YOUR aeroplane taken in part exchange for any of our 400 used cars or 100 new cars always in stock. If your plane is worth more than the car or deposit required for a hire purchase transaction we will gladly refund the cash difference.—Raymond Way, Kilburn, London, N.W.6. Maida Vale 6044. [0604

BRITISH
WIRE THREAD INSERTS
Precision made in Carbon Steel for Aluminium and Magnesium. Also in Stainless Steel and Bronze.
B.S.F. · Metric · B.S.P. · B.A.
Whitworth · Unified
CROSS MANUFACTURING CO. (1938) LTD
COMBE DOWN BATH SOMERSET

LEAVE COMPETITORS BEHIND
WITH A CESSNA

Write for details to
W.H. & J. ROGERS (ENGINEERS) LTD.
Great Barford, Bedford

There is a **JODEL** *for you.*
Either the **AMBASSADEUR** 3 seater or the **MUSKETEER** 4—5 seater.
U.K. Agents:
ROLLASON AIRCRAFT & ENGINES LTD.
REDHILL AIRPORT · · · SURREY
Telephone: NUTFIELD RIDGE 2212

Airline Air Spares
KEEPS THEM
AIRBORNE

at Southend Airport . . . where AIRLINE AIR SPARES offer an unparalleled stock of VISCOUNT, DC4, VIKING and BRISTOL 170 spares

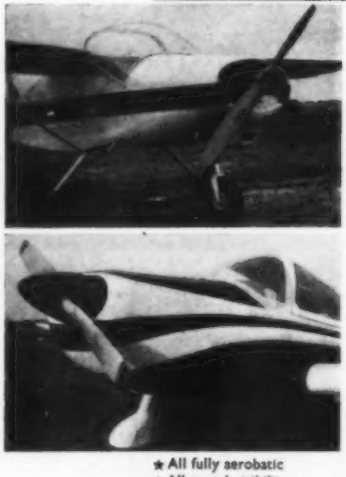
GROUND EQUIPMENT — Hydraulic jacks, ground starters. Engine stands, maintenance equipment, etc.
WORKSHOP EQUIPMENT—Hanovia crack test equipment, tank inspection units, engine and power plant slings, etc.

Airline Air Spares
ASSOCIATED W. A. LTD
T. D. KEEGAN LTD.
SOUTHEND AIRPORT, SOUTHEND-ON-SEA, ESSEX
Mr. EDWARDS, Southend 47528 Mr. NOBLE, Southend 4383
Tel: Southend 48183/4/5 Grams: Telex 1943

Our Ansafon telephone answering machine records all telephone calls after office hours

BOLKOW

A NEW EXPERIENCE IN FLYING AND TRAVEL, SPEED AND SAFETY WITH ECONOMY AND COMFORT
2 SEAT BOLKOW JUNIOR
3 SEAT BOLKOW KL107C
4 SEAT BOLKOW F207



★ All fully aerobatic
★ All round visibility
★ Price range to suit all pilots from £2,200–£5,500
★ All cruise at approximately 145 mph

BÖLKOW-ENTWICKLUNGEN KG
BÖLKOW-APPARATEBAU GMBH
STOCKDORF BEI MÜNCHEN
Sole Agents for U.K.:
FLAIR-AVIATION SALES COMPANY LIMITED
TOWER HOUSE, COLLEGE ROAD, BROMLEY, KENT
Tel. SAYENDBOURNE 7201/4/5 AIRPORT-DIDCOT HILL, KENT

CLOTHING, FOR SALE OR WANTED

R.A.F. officers' uniforms purchased, good selection of R.A.F. officers' kit for sale, new and reconditioned. Fisher's Service Outfitters, 86-88 Wellington Street, Woolwich. Tel.: Woolwich 1055. [0567

CLUBS

SURREY AND KENT FLYING CLUB, Biggin Hill (BN9) 2255. M. of A. approved course. Tiger and Hornet Moths, Chipmunks and Prentice. Contract rates. Route 705, one hour from Victoria. [0292

ELECTRICAL EQUIPMENT

ELECTRICAL Connectors. More than 1,000,000 in stock, covering over 50 different ranges. British and American. Stock list on application to Sasco, Nutfield, Redhill, Surrey. Tel.: Redhill 5050. [0054

FOR CHARTER

AIR LINKS have a DC3 fleet available for charter, up to 36 seats or freight from Gatwick or Leeds Airport. Enquiries to Air Links, Gatwick Airport. (Tel. No. Livingstone 8811, ext. 6543.) [0236

FOR SALE

QUANTITY of Tiger Moth spares, Gipsy Major engines and engine spares and propellers for sale. Inspection invited. Crop Culture (Aerial) Ltd., Bembridge, I.o.W. [0305

B. S. T. AERONAUTICAL
AN8 APPROVED CO. LTD.
C47 - DC3 Specialists

1. AN Materials, Filaments, Voltage Regulators, Reverse Current Relays
2. Main wheels complete, Wheel and Brake spares
3. Pumps, Starters, Generators, Tacho Generators, Vibrators
4. Engine Mounts, Bolts, Brushes, Sandwich rubbers
5. Anti-drag Rings complete, Flap Assemblies and spares
6. Hydraulic Regulators, Selectors, Retractors and Compensating Jacks

84 ALEXANDRA ROAD
FARNBOROUGH HAMPSHIRE
Telephone FARNBOROUGH 2881 2 3

Send your ELECTRICAL OVERHAUL and REPAIR WORK to
WHITTEMORE'S
OF COURSE!
Biggin Hill 2211 (PBX) Kent

The . . .
British Air Line Pilots Association
81 NEW ROAD, HAYES, MIDDX.
Tel. HAYES 3442/3/4

Membership open to all commercial and Service pilots. For full details concerning objects and particulars of membership please write to the General Secretary.

GROUND EQUIPMENT

SURPLUS TEST EQUIPMENT for sale. Hydraulic, pneumatic, vacuum, electrical, low temperature, instrument, propeller, tensile impact, creep, crack detection, etc. Send requirements. L. Solloman Ltd., 1 Beaufort Street, Manchester, 3. Phone BLAckfriars 4571. [0452

HIRE PURCHASE

HIRE purchase on your own plane. We will buy your machine and hire purchase it back to you over three years.—Raymond Way Motors Ltd., Kilburn, N.W.6. MAida Vale 6044. [0247

LINK TRAINERS

LINK TRAINERS. D.4 Mark 1 with V.O.R. for sale. Vendair, Biggin Hill 2251/2. [0453

PACKING AND SHIPPING

R. & J. PARK LTD., Dominion Works, Thames Road, Chiswick, London, W.4. Phone: Chiswick 7761. Official packers and shippers to the aircraft industry. [0012

PUBLIC APPOINTMENTS

MINISTRY OF AVIATION, Chessington, Surrey, requires Technical Author for preparation of technical publications on aircraft instruments and instrument systems. *Quals.* Recognised eng. apprenticeship or equiv. training. O.N.C., C. & A. Final Certs. or equiv. Previous exp. of writing or editing technical matter an advantage. *Salary* £1,028-£1,173. Technical College courses sponsored for suitable candidates. Good prospects for promotion and pension.—Application forms from Manager (PE.3159), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. [2401

RADIO AND RADAR

AFTER Sales Services. This is important with modern complex equipment. Make sure you order your new equipment through A. J. Whittemore (Aeradio) Ltd., Biggin Hill, Kent, Biggin Hill 2211. [0302

SERVICES OFFERED

REPAIRS and C. of A. overhaul for all types of aircraft. Brooklands Aviation Ltd., Civil Repair Services, Sywell Aerodrome, Northampton. Tel.: Moulton 3251. [0307

AIRCRAFT RADIO MAINTENANCE

INTERNATIONAL AERADIO LIMITED
invite applications for "A" and "B" licensed
AIRCRAFT RADIO MAINTENANCE ENGINEERS
for service in Nairobi and Khartoum

A tax-free salary will be paid plus married and child allowances. (For example, an "A" and "B" licensed engineer in Khartoum married with two children, would receive initially a total of £2,057 per annum.) In addition, free furnished accommodation and free medical attention is provided with generous U.K. leave. These positions are permanent within a world-wide organisation and carry membership of an excellent pension scheme.

Written applications giving age, qualifications and experience should be made to

Personnel Manager,
40 Park Street, W.1

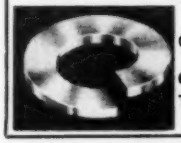
MINISTRY OF AVIATION

Air Traffic Control Officers

Posts for men or women at least 23 and under 35 on 1/7/61. Candidates must have had recent aircrew experience, preferably as pilot or navigator in civil air transport or H.M. Forces; but exceptionally, extensive experience in A.T.C.O. duties may be accepted. They should normally also have G.C.E. with five passes, or an equivalent academic qualification. Starting salary (London) from £872 to £1,251. Maximum £1,599. Appointment initially unestablished, but prospects of establishment and promotion. Apply:

MINISTRY OF AVIATION,
Est 5 (a) 1/R 758, The Adelphi,
John Adam Street, London, W.C.2

Perfect Precision Aircraft Spring Washers
to B.S. Spec. 2 SP. 47



CROSS MANUFACTURING CO. (1938) LTD.
Combe Down · Bath · Som.
Tel: Combe Down 2355/8
Grams: Circle, Bath

SITUATIONS VACANT

PLANNING ENGINEER required with knowledge of machined and sheet metal details.—Apply stating experience, age and salary required to the Manager, Brooklands Aviation Ltd., Buttocks Booth, Moulton, Northampton. [2393

AIRFRAME FITTERS required for repair and overhaul of Ministry of Aviation aircraft. Ex R.N.A.S. or R.A.F. personnel preferred. 42 hour, 5 day week. Canteen facilities. Free transport from Kettering, Northampton, Bedford and St. Neots areas. Apply in person or by letter to Brooklands Aviation Ltd., Little Staughton Aerodrome, near St. Neots, Hunts. Tel.: Colmworth 333. [2394

A. & C. LICENSED ENGINEER required, experienced on Dove and light aircraft. Apply Tyne Tees Aviation Engineering Ltd., Woolsington Airport, Newcastle upon Tyne. [2364

CHIEF GROUND INSTRUCTOR required immediately to establish ground training section of one of the foremost flying schools in the United Kingdom. Training up to ALTP standard. Good salary and excellent prospects to right candidate. Box No. 7439. [2385

CHIEF DESIGNER, also Stressmen and Draughtsmen required to work in small Company on interesting light aircraft design project. Permanent position and possible assistance with housing. An exceptional opportunity for experienced men with ideas, initiative and drive. Box No. 7425. [2374

GROUND ENGINEER, A and C. Austers. Box No. 7465. [2413

ELECTRO-HYDRAULICS LIMITED, Warrington, require Technical Authors with experience in the compiling of Servicing Manuals for aircraft landing gear and hydraulic equipment. Knowledge of M. of A. and A.T.A. procedure desirable but not essential. Salary in accordance with experience.—Apply to Personnel Manager, Electro-Hydraulics Limited, Liverpool Road, Warrington, Lancashire. [2403

RADIO SERVICE ENGINEERS and Instrument Mechanics required to service airborne navigational equipment, London Airport. The Decca Navigator Co. Ltd., Spur Road, Feltham, Middlesex. Telephone: Feltham 4898. [2419

COLLEGE OF AIR TRAINING
HAMBLE, SOUTHAMPTON

Applications are invited for appointment as a

TECHNICAL INSTRUCTOR

Duties involve lecturing in Science and Air Navigational subjects. Applicants must be Air Pilots or Navigators, possessing a civil Flight Navigator Certificate of Competency. Alternatively, R.A.F. "N" or "n" qualifications would be acceptable. Salary in the range £1,010 to £1,325 according to qualifications. Contributory Pension scheme.

Applications to Bursar

[2410

COLLEGE OF AIR TRAINING
HAMBLE, SOUTHAMPTON

Applications are invited for appointment as a

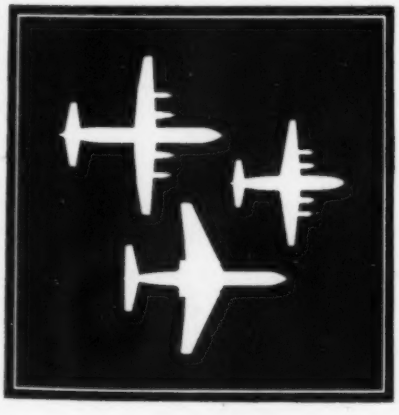
Lecturer in Aerodynamics or Thermodynamics

Good technical qualifications and recent teaching experience are essential.

Salary in the range £1,010 to £1,325 according to qualifications. Contributory Pension Scheme.

Applications to Bursar

[2409



Airframe Fitters · Radio Fitters · Instrument Repairers · Aircraft Electricians
Plant Maintenance Fitters · Plant Maintenance Electricians · Draughtsmen
Stores Assistants · Clerk Typists · Firemen · Labourers

We want **SKILLED TRADESMEN**
and other staff

We offer permanent jobs with good pay, pensions and insurance
first class working conditions, excellent catering and recreation facilities

Write, call or 'phone (Skyport 3131) Personnel Officer, BEA Engineering Base
London Airport, Hounslow, Middlesex (Bus 203 from Hounslow West to Hatton Cross)

BEA

also **STATION CHARGEHANDS**

Licensed Aircraft Engineers to supervise pre-departure checks and defect diagnosis and rectification procedures. At least 5 years' practical experience, and ability to extend qualifications on introduction of new aircraft types, essential.

Plessey

Aircraft Electrical Division
Laboratories - Romford Essex

electrical designer

mechanical designer

development engineer

AND SUPPORTING

draughtsmen

AIRCRAFT ELECTRICAL POWER GENERATION

The opening of laboratories at Romford, Essex, for new long-term development projects has created these senior appointments for qualified engineers with generation experience. Generous and progressive salaries. Applications which will be treated in confidence should be addressed to:

The Regional Personnel Manager, The Plessey Company Limited, Vicarage Lane, Ilford, Essex.

CLASSIFIED ADVERTISEMENTS

Use this Form for your Sales and Wants

To "Flight" Classified Advertisement Dept., Dorset House, Stamford St., London, S.E.1.
*** Telephone: WATerloo 3333 ***

PLEASE INSERT THE ADVERTISEMENT INDICATED ON FORM BELOW

- **RATE:** 1/2 PER WORD, MINIMUM 14/-.
- NAME AND ADDRESS TO BE INCLUDED IN CHARGE IF USED IN ADVERTISEMENT.
- BOX No. if required, add 2 words plus 1/-.
- Cheques, etc., payable to "FLIGHT" crossed "& Co."
- **PRESS DATE: FIRST POST THURSDAY** for following week's issue.

NAME .....

ADDRESS .....

.....

			Please write in BLOCK LETTERS with ball pen or pencil.		

NUMBER OF INSERTIONS REQUIRED..... **REMITTANCE VALUE** .....**ENCLOSED**

STRAD

Senior
Commissioning Engineers

Strad is our new automatic electronic retransmission system. The first important installations of the current mark of equipment are now in progress, and a heavy expansion programme is under way. We urgently require men of ability, experience and authority to control these installations and head up our commissioning teams.

For Senior Commissioning Engineers we are looking for men with technical knowledge of at least H.N.C. or graduate level, a good all round engineering background in electronics, and an ability to deal with the day to day problems of local administration. Such men will already hold senior and responsible posts.

Engineers with experience on advanced logic design, switching, missile systems, computers, and comparable equipments, are invited to reply. Comprehensive familiarization and appraisal courses are currently being mounted to give a thorough training in all aspects of the equipment.

The appointments carry generous non-contributory benefits, together with solid allowances for applicants from outside the London area. Confidential interviews will be arranged with our engineers in London and the provinces.

Please write details of career and qualifications to:

L. L. Locket, Personnel Manager, Strad Division,

Standard Telephones and Cables Limited

114 Chase Side, Southgate, London, N.14

AVIATION TRADERS (ENGINEERING) LIMITED

A BRITISH UNITED AIRWAYS COMPANY

Have vacancies as follows:

(a) **ONE INTERMEDIATE WEIGHTS ENGINEER** based at Southend-on-Sea, for varied work on Carvair and other new Civil Aircraft Projects and aircraft of British United Airways Fleet.

(b) **ONE INTERMEDIATE WEIGHTS ENGINEER** based at London (Gatwick) Airport, responsible to Chief Weights Engineer at Southend-on-Sea, for work on British United Airways Fleet Aircraft Loadings, etc.

(c) **FOUR SENIOR AIRCRAFT STRUCTURAL DRAUGHTSMEN** based at Southend-on-Sea for work on Carvair and other new Civil Aircraft Projects.

(d) **THREE SENIOR AIRCRAFT DRAUGHTSMEN** with experience of Aircraft controls and Mechanisms, based at Southend-on-Sea, for work on Carvair and other new Civil Aircraft Projects.

Five day 38 hour week. 3 weeks annual leave, plus statutory holidays. Superannuation and sickness benefit schemes are in operation.
Special reduced air travel fares are available for staff and families.

Apply in writing giving details of experience, qualifications and salary required to:
Chief Designer, Aviation Traders (Engineering) Ltd., Municipal Airport, Southend-on-Sea, Essex

THE DE HAVILLAND ENGINE COMPANY LIMITED

CONTRACTS OFFICE

Two male clerks with relevant experience are required for work in connection with Air Ministry Contracts.

Good salaries will be paid. Excellent working conditions. 5 day week. Contributory pension scheme. Free life assurance.

Please apply to:

The Personnel Officer (Ref. S.C. 169)
The de Havilland Engine Company Limited,
Leavesden, Nr. Watford, Herts.

Member Company of the Hawker Siddeley Group

SITUATIONS VACANT

ASSISTANT AIRCRAFT ENGINEER
Required by
GOVERNMENT OF TANGANYIKA

Ministry of Lands and Surveys on contract for one tour of 21-27 months in first instance. Salary (including Overseas Allowance) according to experience in scale £978 rising to £1,239 a year. Gratuity 25 per cent total salary drawn. Outfit allowance £45. Free passages. Liberal leave on full salary. Quarters provided at moderate rental. Education Allowances payable.

Candidates must have had training in general aeronautical engineering with at least 3 years subsequent experience of airframe and engine maintenance. They must be capable of assisting in the maintenance and overhaul of "Prince," "Commander" and "Apache" aircraft. Opportunities will exist for additional experience for licence qualifications.

Apply to:
Crown Agents
4 Millbank, London, S.W.1,
for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/51415/FE. [2406

MINISTRY OF AVIATION
INTERESTING WORK IN IDEAL SURROUNDINGS FOR SKILLED MEN
To serve as Research and Development Craftsmen

AIRFRAME AERO ENGINE AND ARMAMENT FITTERS
For aircraft servicing installation and special fitting work

INSTRUMENT AND ELECTRICAL FITTERS
For aircraft servicing and instrumentation work.

ELECTRONICS CRAFTSMEN
For experimental and development work on electrical/electronic system and equipment.

RADIO/RADAR CRAFTSMEN
For servicing air and ground installation and equipment.

FITTERS, TURNERS AND GENERAL MACHINISTS
For experimental and development work (toolroom standard).

at
AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN, SALISBURY, WILTSHIRE

Pay normally starts at £10 8s. 2d. (including 10s. merit lead) or £12 8s. 2d. (including 50s. merit lead) per 42 hour 5-day week, according to experience and can be reassessed within three months up to £14 8s. 2d. according to ability. Revised pay will be retrospective to date of entry. Overtime at enhanced rates. Two weeks' paid holiday. Paid Sick Leave Scheme. Assistance given under a temporary scheme towards cost of travel between home and work in certain circumstances. Hostel accommodation available for single or unaccompanied applicants.

Apply giving details of apprenticeship or experience in H.M. Forces to:
Personnel Officer (F.), A. & A.E.E.,
Boscombe Down, Salisbury, Wiltshire
[2402

PILOT required for Smiths Aviation Division Flying Unit, based at Staverton Aerodrome, Gloucestershire. Duties include experimental, development and demonstration flying of complete Instrument Systems including Automatic Landing. Good opening for C.P.L. holder (or equivalent), preferably aged about 25. Permanent staff appointment and good pension scheme for suitable applicant. Apply to The Personnel Manager, S. Smith & Sons (England) Ltd., Aviation Division, Cheltenham Road, Bishops Cleeve, Nr. Cheltenham, Glos., marking application for the attention of Administration Executive. [2417

SKILLED AIRFRAME and Piston Engine Fitters required, pleasant working conditions, good bonus. Interesting variety British and American Aircraft. Special vacancy for ex-regular R.A.F. or F.A.A. N.C.O. with recent Service experience on piston engines. Apply Personnel Manager, Western Airways Ltd., The Airport, Weston-super-Mare. [2418

CALEDONIAN AIRWAYS (PRESTWICK) LTD., require Licensed Aircraft Engineers with "A" and/or "C" licences covering DC7C aircraft. Licensed Engineers without DC7C will also be considered. Based at Gatwick and Prestwick as Station Engineers. Starting salary of £1,200 minimum, depending upon experience. Please apply to D. H. Walter, Technical Director, Caledonian Airways (Prestwick) Ltd., 101 Victoria Road, Horley (4446/7). [2408

REGISTRAR/GROUND INSTRUCTOR required to handle ground training, discipline, records, etc., of students on courses for professional Pilots' Licences. Details and forms of application from the London School of Flying Ltd., Elstree Aerodrome, Elstree, Herts. [2407

SITUATIONS WANTED

A.L.T.P. 5,000 HOURS. Viscount, Dakota, Rapide, etc. Group 1. Full Instructor's Rating, requires position, preferably London area. Box No. 7467. [2414

PILOT, SCPL, I/R, F/Nav. 1,750 hours Pilot. 9,500 hours Navigator. Box No. 7466. [2415

SITUATIONS WANTED

EXPERIENCED TRANSPORT PILOT and Flying Instructor (37), leaving RAF December 1961, seeks position, anything considered. Box 7747. [2398

PILOT, C.P.L., I/R, R/T. Perf A. Requires flying post anywhere in U.K. Box No. 7425. [2368

PILOT, ALTP, 8,000hrs, DC6, Viscount, Viking, Argonaut York. Box No. 7426. [2369

COMMERCIAL PILOT (USA), instrument, 4,000hr, 1,600 multi in charge, 700 turbine, British Commercial, instrument, R/T within month; ATR soon. Worldwide experience includes Stratocruiser, Constellation, DC-4, Dakota, Military Multi Jet. Desires co-pilot position, type rating assistance, eventual captaincy. Work anywhere. Prefer international. Box No. 7464. [2411

TUITION

SOUTHEND-ON-SEA MUNICIPAL FLYING SCHOOL. Commercial and Private Pilot's training. Instructors' Courses, night flying every night. Rates from £4 (contract). No entrance fee or subscription. Municipal Airport, Southend-on-Sea. Southend-on-Sea 40201. [0450

TUITION

DENHAM LINK TRAINING CENTRE, D4 and ANT 18 Trainers. Instrument Ratings, Renewals and latest procedures for flights to any Aerodrome in the World. 21s. an hour. Denham 3171. [0295

BRITAIN'S ONLY AVIATION SCHOOL

AIRWORK SERVICES TRAINING PERTH

offering *all* these courses:—

* commercial and private licences
* instrument rating
* aircraft engineering
* full residential facilities

MINISTRY OF AVIATION APPROVED

Airwork Services Ltd.,
35 Piccadilly, London, W.1

TUITION

LEARN TO FLY, £37; Instructor's Licence and Instrument flying for £4 12s. 6d. Night flying £5 12s. 6d. per hour. Residents 6 guineas weekly. Specialised Course for Commercial Pilot's Licence. Wiltshire School of Flying Ltd., Thruxton Aerodrome (Andover Junction, 1hr 15min from Waterloo), Hants. [0253

A.F.R.Ae.S., A.R.B., Certs., A.M.I.Mech.E., etc. on "No Pass—No Fee" terms. Over 90% successes. For details of Exams and Courses in all Branches of Aeronautical work, Aero Engines, Mechanical Eng., etc., write for 148-page Handbook—free B.I.E.T. (Dept 702), 29 Wright's Lane, London, W.8. [0707

LONDON SCHOOL OF AIR NAVIGATION offers full-time personal coaching with Home Study Correspondence Courses or combination of both for all aspects of professional pilot and navigation certifications, also PPL. Officially appointed Services Courses Scheme, 33 Ovington Square, Knightsbridge, London, S.W.3. KEN 8221. [0510

AVIGATION LTD. provides full-time or postal tuition or a combination of these methods for M.T.C.A. pilot-navigator licences. Classroom instruction can be provided for A.R.B. General, certain specific types and performance schedule examinations. D4 Links. Ring RODney 8671. For details apply Avigation Ltd., 30 Central Chambers, Ealing Broadway, London, W.5. EALing 8949. [0248

the "Executive" Headset

by ANTICOUSTIC

★ *Light weight (Approx. 10oz.)*

★ *Noise cancelling Boom Microphone*

★ *Air/foam Ear Pads*

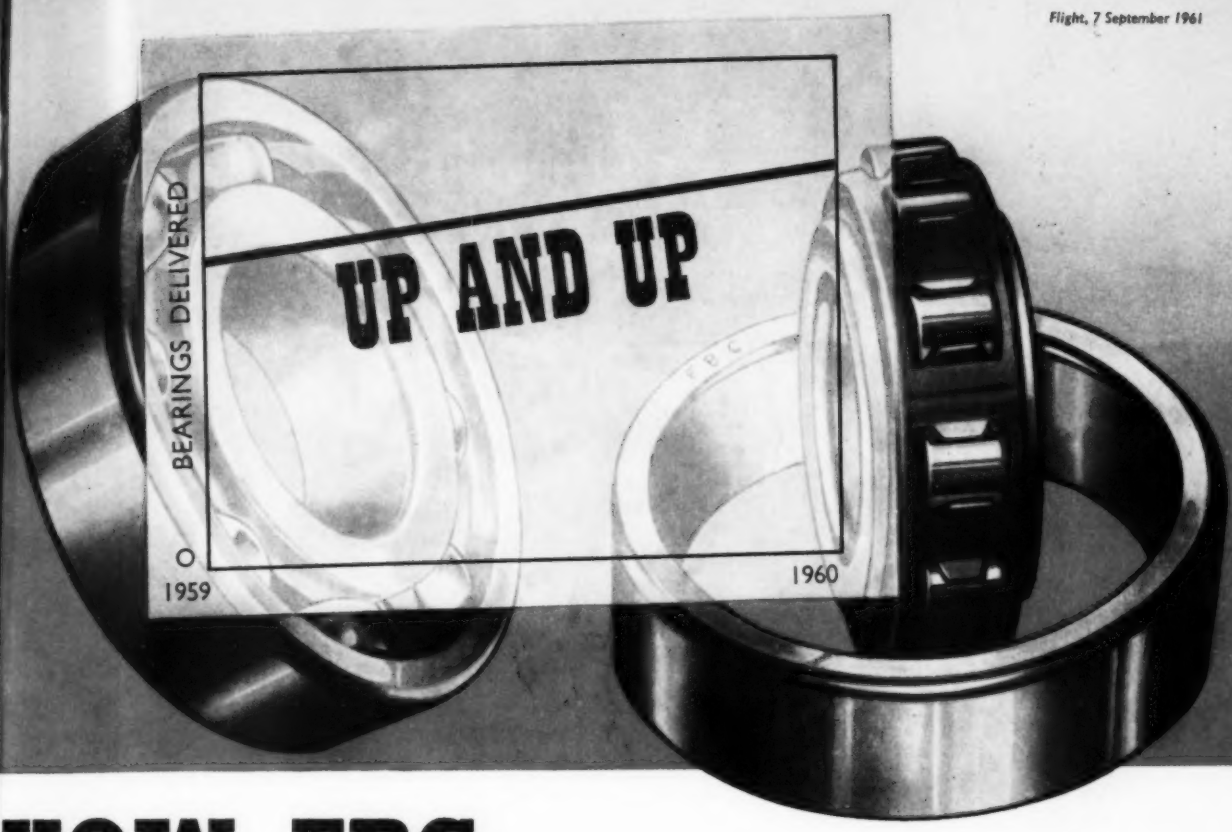
★ *Optional colour schemes*

THE ANTICOUSTIC COMPANY, 7 MILLMEAD, GUILDFORD, SURREY. Phone: Gfd. 66488

INDEX TO ADVERTISERS

	Page
Abbey Panel and Sheet Metal Co. Ltd.	67
Aero Controls Ltd.	80
Aircraft Materials Ltd.	8
Airline Air Spares Ltd.	84
Airmed Ltd.	64
Airwork Ltd.	65, 83, 88
"Amateur Photographer"	76
Amber Oils Ltd.	68
Amphenol Borg Ltd.	81
Anticoustic Co., The	88
Armstrong Patents Ltd.	73
Associated Electrical Industries Ltd.	Facing Edit page 405
Attewell & Co. Ltd., B.	78
Automotive Products Ltd.	79
Aviation Traders (Engineering) Ltd.	87
B.E.A.G.L.E.	31
Bell's Asbestos & Engineering Co. Ltd.	70
Benson (A.I.F.) Ltd., J. J.	78
Boulton Paul Aircraft Ltd.	1
B.P. Aviation Service	Facing Edit page 387
Bristol Siddeley Engines Ltd.	41
British Airline Pilots Association, The	84
British European Airways	85
British Refrasil Co. Ltd., The	Between Edit pages 404-405
Britool Ltd.	78
Brown Ltd., N. C.	68
B.S.T. Aeronautical Co. Ltd.	84
Burnley Aircraft Products Ltd.	11
Camloc Ltd.	66
Cathodean Crystals Ltd.	16
Clifford Ltd., Peter S.	82
Cossor Radar and Electronics Ltd.	42
Cross Manufacturing Co. (1938) Ltd.	84, 85
C.W.C. Equipment Ltd.	72
Decca Radar Ltd.	9
Docker Bros. Ltd.	Between Edit pages 404-405
Dundas Ltd., R. K.	83
Eastern Aero Electrical Services Ltd.	70
Ekco Electronics Ltd.	65
Electronic Computer Exhibition	52
Elliott Brothers (London) Ltd.	Between Edit pages 404-405
English Electric Co. Ltd., The	44
E.N.V. Engineering Co. Ltd.	68
Equator Wheels	70
Esso Petroleum Co. Ltd.	Between Edit pages 386-387, 36
Fafnir Bearing Co. Ltd.	Cover iii
Fairey Engineering Ltd.	63
Ferranti Ltd.	5, 69
Fibreglass Ltd.	6
Flair Aviation Sales Co. Ltd.	84
Flight Refuelling Ltd.	25, 50
Fox Ltd., C. J.	76
General Precision Systems Ltd.	13
G. Q. Parachute Co. Ltd.	24
Graseby Instruments Ltd.	54
Graviner Manufacturing Co. Ltd.	34
Harleyford Publications Ltd.	78
Hawker Siddeley Aviation	22, 87
High Duty Alloys Ltd.	21
Hobson Ltd., H. M.	7, 82
Hong Kong Aircraft Engineering Co. Ltd.	66
Hordern-Richmond Ltd.	12
Hymatic Engineering Co. Ltd., The	3
Iliffe Books Ltd.	74
International Aeradio	85
Keegan Aviation Ltd.	64
Mallinson and Sons Ltd., Wm.	75
Marconi's Wireless Telegraph Co. Ltd.	49, 51, 53
Martin-Baker Aircraft Co. Ltd.	43
Mercury Truck & Tractor Co. Ltd.	10
Microcell Ltd.	Facing Edit page 404
Miller Aviation Ltd.	78
Ministry of Aviation	85
M.L. Aviation Co. Ltd.	77
Motoimport	20
Murex Welding Processes Ltd.	19
Napier and Son Ltd., D.	Between Edit pages 404-405
Normalair Ltd.	48
Page Engineering Co. (Sunbury-on-Thames) Ltd.	14
Park Ltd., R. and J.	66
Plessey Co. Ltd., The	Between Edit pages 376-377, 86
Pye-ling Ltd.	26
Racal Instruments Ltd.	71
Rapp Ltd., Leo	79
Rist's Wires and Cables Ltd.	Cover iv
Rogers Ltd., W. H. & S.	84
Rollason Aircraft & Engines Ltd.	84
Rolls-Royce Ltd.	Cover i, 32-33
Rotax Ltd.	Between Edit pages 386-387
Scottish Aviation Ltd.	72
Short Bros. & Harland Ltd.	80-81
Smart & Brown (Machine Tools) Ltd.	73
Societe Anonyme des Ateliers d'Aviation	15
Sperry Gyroscope Co. Ltd.	45
Standard Telephones & Cables Ltd.	87
Technical Platings Ltd.	75
Thermal Control Co. Ltd.	72
Thorn Electrical Industries Ltd.	2
Triplex Ltd.	35
United Aircraft International Inc.	Cover ii
Vandervell Products Ltd.	46-47
Walter Ltd., A. J.	80
Ward Brooke and Co. Ltd.	77
Westair Flying Services	82
Western Manufacturing (Reading) Ltd.	18
Westland Aircraft Ltd.	23
Whiteley Electrical Radio Co. Ltd.	74
Whittemore (Aeradio) Ltd., A. J.	84
Williamson Manufacturing Co. Ltd.	4
Wilson and Sons (London) Ltd., W.	17

Printed in Great Britain for the Publishers, ILIFFE TRANSPORT PUBLICATIONS LTD., Dorset House, Stamford Street, London, S.E.1, by THE GARDEN CITY PRESS LIMITED, Letchworth, Hertfordshire. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service Ltd., Gordon & Gotch Ltd. SOUTH AFRICA: Central News Agency Ltd.; Wm. Dawson & Sons (S.A.) Ltd. UNITED STATES. Eastern News Co., 306 West 11th Street, New York 14.



HOW FBC ARE GROWING!

Last year F.B.C., with their augmented resources, their extended range of bearings and their reputation for quality, enjoyed a massive increase in the scope and volume of business.
F.B.C. have installed improved research facilities, and are building new factory extensions, confident in the continuance of the F.B.C. upward trend.

FAFNIR BEARING COMPANY LTD., WOLVERHAMPTON

A Wide Range
of

DEEP-GROOVE BALL BEARINGS WITH AND WITHOUT INTEGRAL SEALS

•

PARALLEL ROLLER BEARINGS

•

HIGH-PRECISION ANGULAR-CONTACT MACHINE TOOL BEARINGS

•

MINIATURE BEARINGS FOR INSTRUMENTS ETC.

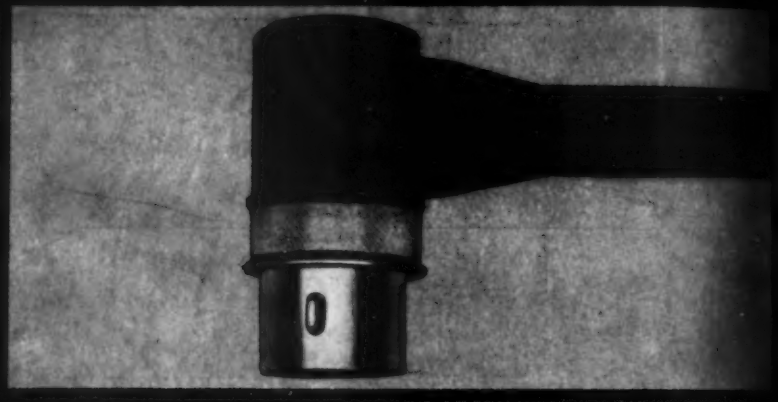
F·B·C
FAFNIR

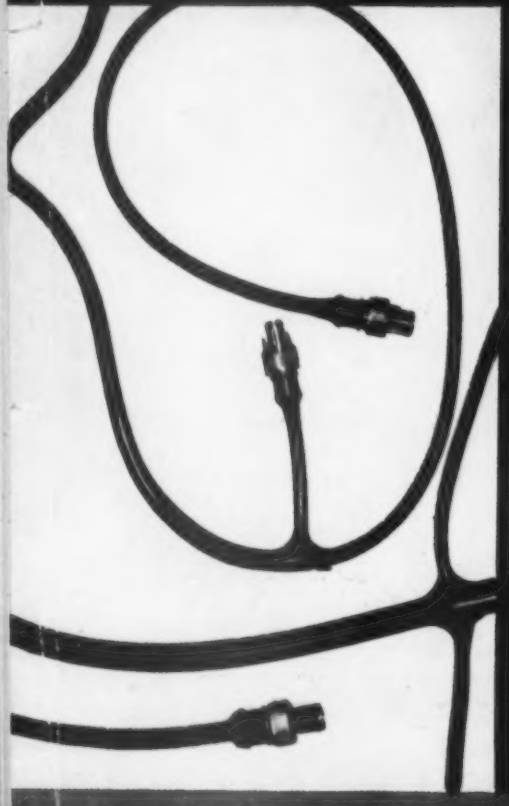
A REPUTATION FOR FINE QUALITY
AN INCREASED RANGE OF BEARINGS
GREATLY AUGMENTED FACILITIES

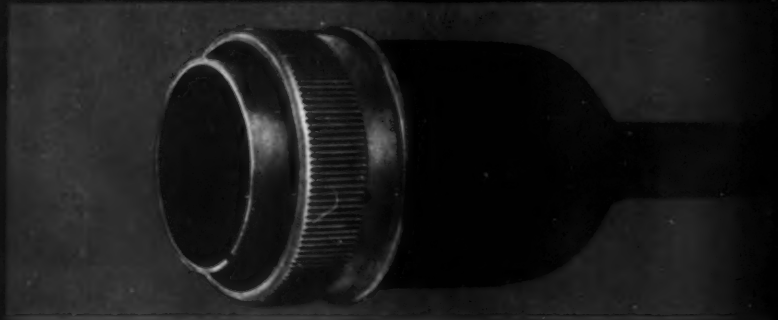
REGD. TRADE MARKS: F.B.C., FAFNIR.

MOULDED ELECTRICAL ASSEMBLIES

RIST'S







ASSEMBLIES MANUFACTURED

- TO OUR DESIGN or
- TO YOUR SPECIFICATIONS
- FOR ALL ELECTRICAL APPLICATIONS
- *Write for more information*

The upper and lower illustrations on the left hand side are reproduced by kind permission of Rolls Royce Limited

RIST'S WIRES & CABLES LIMITED

LOWER MILEHOUSE LANE · NEWCASTLE · STAFF